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October 15, 2003

Mr. Nabil S. Fayoumi
U. S. Environmental Protection Agency - Region 5
Superfund Division
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Re: Project Plans
Groundwater Migration Control System
Sauget Area 2 – Sites O, Q, R And S
Sauget, Illinois

Dear Mr. Fayoumi:

Attached to this letter are three copies of each of four project plans submitted to Solutia by the slurry wall contractor, Inquip Associates. These plans are being submitted for your information. They include the following:

- The contractor's Project Health and Safety Plan, which is consistent with the Project Health and Safety Plan submitted to you by Solutia on January 31, 2003.

- The Construction and Quality Control Plan, which describes the methods to be used for construction of the slurry wall and the Construction Quality Control tests to be performed as part of the overall Quality Assurance Plan.. That plan was initially submitted to you on January 31, 2003 and a revised version specifically directed at slurry wall construction was submitted on July 3, 2003.

- The Hydraulic Barrier Plan. This plan includes construction specifications and drawings for the barrier wall.

- The Stormwater Pollution Prevention Plan. This plan is required by the General NPDES permit issued by the Illinois Environmental Protection Agency for construction of the barrier wall.

If you have any questions about the attached plans please do not hesitate to call me.

Sincerely,

Solutia Inc.

Gary W. Vandiver for Richard Williams

Gary W. Vandiver
Project Coordinator

cc: Steven D. Acree - USEPA
Ken Bardo - USEPA
Sandra Bron - IEPA
Tim Gouger – USACE
Mike Coffey - USF&W
Peter Barrett – CH2M Hill
Linda Tape - Husch & Eppenberger
Cathy Bumb - Solutia
Bruce Yare – Solutia
Richard Williams - Solutia

SECTION 02222
HYDRAULIC BARRIER

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

Construct a minimum 3.0 ft wide soil-bentonite backfill barrier to the limits shown on the Contract Drawings. Minimum criteria for construction and criteria for the completed barrier are specified on the Contract Drawings and in this Section.

The Owner's Engineer is performing compatibility testing to evaluate backfill performance when permeated with site groundwater, and mix design testing to determine if added dry bentonite or imported clay are beneficial to backfill performance. The requirement for imported materials referenced in this Section will be determined by the Owner.

Determine, provide, and operate detailed designs, means, methods, and equipment required to meet the specifications and to account for field conditions. Prepare and manage slurry. Excavate trench to the limits shown. Blend trench excavation spoils, imported clay or dry bentonite (if required), and bentonite slurry into a low permeability backfill. Place backfill in a controlled manner to cover prepared and approved trench bottom. Perform Quality Control sampling, testing, and measurements. Manage storm water during construction to divert storm water from construction areas; collect and transport water impounded in active work areas for disposal. Stabilize and dispose waste slurry and excess excavation spoils on site. Clean the site of construction spoils, mud, and debris. Place storm water diversion berms around work areas, and maintain storm water runoff for duration of work.

1.02 SECTION INCLUDES

Provision of all materials, labor and equipment required for the complete installation of the hydraulic barrier, including but not limited to the following:

A. Furnish, prepare, and maintain bentonite slurry.

B. Provide survey and support Quality Assurance testing/measurements.

C. Protect adjacent utilities, structures, test wells and piezometers from damage.

D. Excavate 3.0 ft wide slurry-filled trenches to the limits shown on the Contract Drawings.

E. Furnish trench inspection tools, and labor.

F. Clean trench bottom and backfill surface of sediment, excavation spoils, or other material before placing backfill.

G. Prepare Soil-Bentonite backfill using excavation spoils, imported clay or dry bentonite (if required), and slurry. Perform backfill Quality Control testing.

H. Place backfill in a controlled manner on a clean and approved trench bottom.

I. Provide daily reports summarizing construction.

J. Stabilize waste slurry and leave on site where directed by the Owner.

K. Place compacted clay fill cap over cutoff as shown. Place excavation spoils on site where directed by the Owner.

L. Restore slurry trench work areas and adjacent ground to original conditions. Grade to promote storm water runoff. Re-establish drainage swales.

1.03 RELATED WORK

None

1.04 REFERENCES

The work shall be performed in accordance with the applicable rules, regulations, codes and ordinances of Local, State and Federal authorities, and in accordance with the following references:

A. American Petroleum Institute (API) Reference Procedure 13-A for bentonite materials and 13B-1 for Testing Water Based Drilling Fluids:

1. Filtration
2. Viscosity (Marsh Funnel)
3. pH

B. American Society for Testing and Materials (ASTM):

1.	ASTM C 143	Slump of Hydraulic-Cement Concrete
2.	ASTM D 2216	Laboratory Determination of Water (Moisture) Content of Soil and Rock
3.	ASTM D 2217	Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants (See D below)
4.	ASTM D 422	Method for Particle-Size Analysis of Soils
5.	ASTM D 4380	Density Of Bentonitic Slurries

6.	ASTM D 4381	Sand Content By Volume Of Bentonitic Slurries
7.	ASTM D 5084	Measurement of Hydraulic Conductivity of Saturated Porous Materials Using A Flexible Wall Permeameter

C. Bulk Unit Weight shall be measured using a standard 1/10 cubic ft mold of known weight. Prepared backfill shall be placed in the mold in the three lifts, each lift rodded 25 times. Excess backfill shall be screeded off, and the mold cleaned of spoil. The total weight of the test specimen shall be determined to the nearest 20 g (0.05 lb); the bulk unit weight shall be computed from the weight of this known volume.

D. Particle-Size analysis sample weighing more than 8 lbs shall be split for moisture content and sieve analysis. Measured moisture content and measured total weight of sieve analysis specimen shall be used to determine dry weight of sieve analysis specimen. Sieve analysis specimen shall be washed on the No. 200 sieve. Hydrometer testing is not required. The fraction larger than the No. 200 sieve shall be oven dried before sieving. Sieve analysis shall be performed using sieves identified in Part 2.04.C.

1.05 DEFINITIONS

A. Soil Blend -Mixture of excavation spoils and imported clay (if required), meeting gradation specification for Prepared Backfill

B. Prepared Backfill - Homogeneous mixture of Soil Blend, dry bentonite (if required), and bentonite slurry, blended, and tested to specified slump.

C. Slurry Trench - Excavated slurry-filled trench, depth D.

D. Hydraulic Barrier (Cutoff) - Backfilled Slurry Trench with clay cap

1.06 SUBMITTALS

Cost proposal has been submitted to include a hydraulic track excavator capable of reaching depths of 75 ft or greater, and a clamshell excavator(s) to complete trench to final depth.

A. Submit - Upon Mobilizing for Slurry Trench Construction.

1. Name and qualifications of field personnel performing site survey. Name, number of Professional Licensed Surveyor.

2. Supplier name and location of source proposed for imported fill. Provide product QC test data and 100 lb sample.

3. Supplier and type of bentonite proposed for use in backfill. Provide cut sheets.

4. Contractor shall design or provide for approval by Owner:

   (a) Construction details, size, and location of slurry plant, ponds, desanding operation, and trench-side backfill mixing areas.
   (b) Planned sequence of trench construction.
   (c) Method for measuring and sampling excavation spoils to define wet unit weight, dry unit weight, and gradation, for proportioning spoils, imported gravel, dry bentonite, and hydrated slurry to prepare S-B backfill.
   (d) Example mix proportion calculations and data sheets.
   (e) Storm water management controls at each phase of slurry trench progress.
   (f) Materials and means for stabilizing excavation spoils.

5. Survey plan showing location and elevation control points. Place offset baseline stakes to identify construction stations in the field at 10 ft station. Provide elevation of Work Platform for each 10 ft construction station (along centerline of trench).

6. Name and qualifications of Contractor's independent testing company performing Quality Control testing.

7. Complete list of sampling and laboratory test equipment which will be provided in the field for testing of slurry and backfill.

8. Blank test data sheets and summary tables proposed for Quality Control testing of slurry and backfill. All data sheets and computations shall be organized, identifying as a minimum:

   (a) Sample and batch number.
   (b) Sampling location, date, and time.
   (c) Tests performed.
   (d) Specimen weights, measurements, test readings, and test result.
   (e) Summary tables which identify sampling date, time, location, testing date, test results, and specification requirements.

B. Submit **Daily** During Construction:

1. Barrier Construction Progress Reports, including at a minimum:

   (a) Day, month, year, time or work beginning and end; names of workers on site, equipment used (hours) and materials deliveries received.
   (b) Maintain profile of excavation and backfill work performed daily, showing progress of excavation, final trench bottom elevation, and surface of backfill by construction station. Submit part plan 1in=10ft scale daily.

(c) Quantity of bentonite, imported clay, etc. received.
(d) Amount of slurry produced, description and amount of slurry additives used (if any).
(e) Occurrence of special events such as unexpected slurry loss, observed trench side wall instability, obstructions encountered, ground settlement and/or heave, etc.
(f) Summary of downtime or other unproductive time, including time duration, and reason.

2. Quality Control Reports (Submit end of next work day)

(a) Pond and trench slurry Quality Control test results.
(b) Summary of QC tests performed, or samples taken for testing.
(c) Results of Quality Control testing and mix computations performed on Prepared Backfill.
(d) Quantity of approved backfill placed, placement station, source location or batch (relate batch to QA and QC testing).
(e) Settlement plate readings of soil-bentonite backfill settlement, read daily.

C. Submit **At Completion** Of Barrier Construction:

1. Prepare and submit four copies of a construction quality assurance report after completing barrier wall construction. The report shall include the results of all quality control testing and quality assurance testing on the permanent soil-bentonite backfill, and document that the cutoff was constructed in accordance with the drawings and specifications. Include:

(a) As-built survey drawing showing location of barrier centerline every 50 feet along the alignment, and locating any trench excavations outside of the formal barrier alignment. Provide survey control coordinates for construction baseline. Submit five copies stamped and signed by Licensed Surveyor.
(b) List of depth and elevation of final trench bottom, at construction stations 10 ft on center and at turning points in the alignment.

1.07 QUALITY CONTROL

A. The Contractor shall measure the trench excavation, monitor backfill placement, and perform the specified Quality Control testing of slurry and prepared backfill.

B. The Contractor shall perform all sampling for Quality Control testing and Quality Assurance testing by the Owner.

1.08 QUALITY ASSURANCE

A. The Contractor shall have a minimum of five years soil-bentonite backfill slurry trench experience with comparable projects. The Contractor's key supervisory personnel shall each have a minimum of three years experience in slurry trench construction.

B. The Owner shall have access to the Contractor's Quality Control testing facilities at all times.

C. The Contractor shall perform all sampling for Quality Assurance testing.

D. The Contractor shall provide samples to the Owner's laboratory for Quality Assurance testing of the prepared backfill.

PART 2 PRODUCTS

2.01 GENERAL

Materials and equipment required for the work, which are not part of the completed Hydraulic Barrier, shall be determined by the Contractor. Products and equipment shall meet OSHA safety requirements, and conform to any pertinent Federal, State or local law, regulation, or Code.

2.02 MATERIALS

A. Bentonite shall be a pure, high swelling 90 barrel yield, premium grade, 200 mesh or finer, sodium cation base bentonite, consisting primarily of montmorillonite. Dry Bentonite Addition, if required, shall be a pure, high swelling 85 barrel yield premium 30 mesh (or finer) sodium cation base bentonite, consisting primarily of montmorillonite. Bentonite shall conform to the standards set forth in American Petroleum Institute (API) RP-13A, latest revision. Chemically treated bentonite shall be permitted only with the Owner's approval. Bentonite shall have manufacturer's certification that it meets the following API RP-13A requirements:

1. Viscosity – 30 min @ 600 rpm
2. Fltrate Volume 15 cc max
3. >75 Micron 4% wt max
4. Moisture – 10% wt max
5. Yield Point/Plastic Viscosity 3 max

B. Imported Clay, if required, shall be sound, well-graded, mixture of silt and clay, free of organic and other deleterious substances. Imported clay shall have no more than 10% larger tha the No. 200 sieve. The clay borrow source shall be pre-approved by the Owner. Haul trucks shall be empty of soil or water when filled, and shall be weighed empty and full for payment. Trucks shall be covered during haul.

C. Slurry Make-up Water will be supplied by the Owner. It shall be clean, fresh, potable water, free of oil, acid, alkali, organic matter, or other deleterious substances. Total hardness shall be less than 500 ppm.

2.03 SLURRY

A. Slurry shall be mixed in a high shear venturi mixer, and shall be allowed to hydrate for 12 hours or more before placing in the trench. The slurry pond shall be recirculated.

B. Fresh slurry shall consist of a stable suspension of powdered bentonite and water. One day's excavation production of hydrated slurry shall be maintained at all times for use in the event of unanticipated losses from the trench. Fresh slurry shall meet the following requirements:

1. Filtration: 20 cc maximum filtrate loss or less.

2. Viscosity by Marsh Funnel: 40 - 65 seconds.

3. Sand Content: Maximum 2 percent (by volume) maximum.

4. pH: 7 to 9

5. Density: Not less than 63.5 pcf.

(a) Trench slurry and reconditioned slurry shall consist of a stable suspension of powdered bentonite, natural fines, natural sand, and water. Additives which reduce the capacity for suspending sand shall not be added in the trench; treated slurry shall be desanded before it is returned to the trench (settling pond or mechanical desander). Trench slurry shall be sampled from a location within 100 ft of the excavation toe. It shall be sampled 10 ft below the slurry surface, and 10 ft above the trench bottom, and shall meet the following requirements:

(i) Filtration: Filtrate loss 20 cc maximum, with filter cake thickness less than 1/4 inch.

(ii) Viscosity by Marsh Funnel: 40 - 100 seconds.

(iii) pH - 7 to 10.5

(b) Density: 64 pcf to 80 pcf. The bulk density of slurry at bottom of trench shall always be 15 pcf lower than the bulk unit weight of Prepared Backfill.

(c) The Contractor shall be prepared to immediately adjust the pH of the trench slurry as necessary, recirculate slurry within the trench and clean slurry in the trench of debris, sediment, or sand as necessary to achieve the desired properties. In particular, slurry at the bottom of the trench may require recirculation and desanding prior to backfilling the trench with prepared backfill.

C. Slurry Additives

1. Additives such as dispersants, plugging agents, softeners, or thinners, may be added to the make-up water or slurry so as to obtain proper workability of the slurry and efficient use of the bentonite.

2. Additives to the slurry must be approved by Owner prior to use.

3. Additives shall not be added or mixed in the trench, but conditioned slurry may be added to the trench.

2.04 PREPARED BACKFILL

A. Soil Blend used for backfill preparation shall be composed of selected trench excavation spoils, and imported clay fill (if required), thoroughly blended to a uniform distribution of particle sizes and consistency. Soil clods shall be broken down to small sizes (1/4") to the satisfaction of the Owner, only occasional presence of soil clods larger than 3 inches may be accepted. Soil fines shall be evenly distributed throughout. The Soil Blend shall be free of deleterious materials, frozen soil, wood, vegetation, or other debris. All aggregate larger than 3" shall be separated from the soil blend, and excluded from the soil-bentonite backfill. The Owner may require the Contractor to segregate soils with visible signs of contamination, or soils with unusually high VOC concentrations from the excavation spoils or soils stockpiled for backfill mixing.

B. Prepared Backfill shall be composed of a mixture of the Soil Blend, dry bentonite (if required), and bentonite slurry. The proportioning and mixing methods and procedures shall provide uniform distribution of all materials throughout. If dry bentonite is required, the Contractor shall measure soil blend volumes, wet unit weights, and water contents, and shall provide material inventory, haul tickets, weights, etc. to demonstrate that the required minimum amount of dry bentonite has been added based on dry weight of soil blend.

C. The Contractor shall segregate and blend excavation spoils. Sand, gravel, and cobbles shall be separated from the spoils. Imported Clay may be added to the spoils (if required). The Contractor shall attempt to create a Soil Blend within the following gradation range:

U. S. Standard	Percent Passing by Dry Weight	
Sieve Size	Min	Max

3 inches	100	
1 inch	85	-
½ inch	5	100
# 4	60	100
#10	50	100
#40	35	75
#200	20	40

D. Prepared Backfill shall be mixed to a uniform consistency, having a slump ranging from 3 inches to 5 inches. The average of all slump measurements shall be 4 inches or lower. Slump shall be tested immediately prior to placement. Slump may require adjustment after addition of dry bentonite (if required).

E. Prepared Backfill shall have a laboratory tap water permeability of $1x10^{-7}$ cm/sec or lower, except 20% of the test specimens may have a permeability as high as $5x10^{-7}$ cm/sec and 5% of the test specimen may have a permeability as high as $1x10^{-6}$ cm/sec. Consistent permeability greater than $1x10^{-7}$ cm/sec shall be reason for review and revision of backfill materials, preparation procedures, and equipment.

F. Quality Control of backfill is specified in Part 3.

2.05 EQUIPMENT & SUPPLIES

A. The excavator bucket shall be 36 inches wide. Clamshell buckets shall be 36 inches wide. Minor extension of teeth beyond the bucket sides will be considered in the width. Side cutters shall not be used.

B. Backfill mixing equipment shall be capable of shredding clay excavation spoils and thoroughly blending spoils, imported fill, and dry bentonite to a consistent uniform product.

C. Quality Control testing equipment shall meet the requirements of the references and shall be subject to the Owner's approval.

D. Provide mats as needed to permit trench crossings and for equipment support in soft ground areas.

E. Trench sounding tools

1. Trench inspection tools shall be adequate for their intended purpose, shall meet the minimum requirements of this specification, and shall be subject to the Owner's approval.

2. The final depth of the trench may be measured with the pointed weight (described below) or with clamshell excavation equipment outfitted with a calibrated electronic depth control device.

3. Pointed weight: having an end area of 1 square inch, weighing 7 pounds to 9 pounds.

4. Flat weight: having an end area of 20 square inches, and the same weight as pointed weight ± 0.5 lb. It shall have a ½ inch high lip at the edge of the bottom flat area.

5. Measuring tapes shall be marked in 0.1 ft graduations and shall be reinforced.

F. Slurry sampling device shall contain sufficient volume of slurry in a single recovery to perform the complete suite of required tests on untested slurry. The sampling device shall have attached a dedicated measuring tape to permit sampling at known depths.

G. 3 inch OD split spoon soil sampler attached to a plastic coated 1/8" diameter cable. The spoon shall be outfitted with spring retainer baskets. Sampler will be used for sampling the surface of placed backfill.

H. Samples bags shall be air tight re-sealable plastic bags of minimum 20 mil thickness. The exterior of sample bags shall be washed clean to remove soil and contamination. Bags shall be labeled with tags attached to each bag by twisted wire.

2.06 STORAGE AND HANDLING OF MATERIALS

A. Material stockpiles, plant, and equipment laydown shall be placed in areas designated by Owner. Handling and storage of materials and equipment are subject to the Owner's approval.

B. Storage for sample bags shall be in a sheltered room, out of sunlight, in boxes clearly identifying content by date. Sample shipping containers shall be water tight and structurally sound.

PART 3 EXECUTION

3.01 MOBILIZATION

A. Furnish and maintain services and facilities to the extent and at the time the Contractor deems them necessary for operations, consistent with the requirements of the work and this Contract.

B. Examine the site, verify conditions depicted on the Contract Drawings necessary for completion of the work, and determine site preparation needs not enumerated in the Contract Drawings.

3.02 GENERAL

A. The work required to provide facilities, equipment, and services required by this Section shall be done in a safe and workmanlike manner and shall conform with any pertinent local or State law, regulation or code, and jurisdiction of public or private utility companies.

B. Employ construction methods and provide containment or protective coverings which prevent the leakage, spillage, or wind blown excursions of excavated materials, dry bentonite, cement, backfill, or bentonite slurry off site.

C. Place a spill control berm and protect the surface of areas at the river edge to prevent contamination from excavated material, bentonite slurry, or backfill.

D. At the completion of hydraulic barrier construction, all surfaces of adjacent areas and structures shall be restored to their original condition.

E. During construction control storm water to direct storm water away from construction areas.

F. Take all necessary precautions and construction measures to prevent collapse of the excavated slurry trench prior to backfilling.

G. Provide and maintain trench inspection tools.

3.03 WORK PLATFORM

A. A work platform shall be constructed by placing compacted soil across the trench alignment of sufficient width to support the excavation equipment.

B. Suitable materials, moisture content, and compaction effort shall be provided to create a compact working surface which will support the equipment in inclement weather.

C. The surface of the work platform shall be symmetrical and provide even support to the excavator to maintain trench verticality.

D. The surface of the work platform shall be sloped to return slurry to the trench.

E. The work platform shall be removed after construction, but not before the Owner reviews settlement plate readings and authorizes cap construction.

3.04 PROTECTION OF EXISTING TEST WELLS AND PIEZOMETERS

Work of this section will be performed by the Owner. The Contractor shall be aware of the locations and protect them from damage by trench excavation and backfill work.

A. Survey the location of wells or piezometers to be protected.

B. Excavate soil around wells or piezometer.

C. Cut off existing riser pipes 1 ft below the Contractor's working level, and cap pipe.

D. Cover capped pipe with metal plate to protect the well or piezometer from damage and backfill to ground level.

E. Re-establish wells and piezometers to original condition after barrier construction process moves beyond well/piezometer location.

3.05 TRENCH EXCAVATION

A. Use backhoe, excavator, dragline, and/or cable operated clam shell buckets which can excavate the trench full width (see 2.05B) in one pass.

B. Excavation equipment provided shall be capable of removing material of any nature within the limits of the trench required for barrier construction. Clamming, drilling, scraping, chiseling, or other methods shall be used, subject to approval of the Owner. Trench excavation shall be performed with minimum ground vibration.

C. The excavation shall penetrate the subsurface soils to the elevations shown on the Drawings, and shall penetrate bedrock 1-foot, or obtain refusal. Boulders will not be considered as bedrock, and shall be removed from the trench.

D. The Contractor shall place a bar across the trench to mark the toe of the backfill slope. The backhoe bucket shall not extend beyond that marking when removing excavation spoils from the trench.

E. Excavation methods shall not cause slurry waves to overtop the trench and spill onto the work platform. The Contractor shall take all measures necessary to contain losses of bentonite slurry into abandoned utilities, underground voids, or adjacent structures.

F. The slurry trench shall be excavated in a continuous manner to close with the top of bedrock at the elevations shown on the contract drawings. Trench continuity shall be demonstrated by the movement of the trench excavation equipment such that the digging tools can be passed vertically from top to bottom of the trench as well as moved horizontally along the axis of the trench without encountering unexcavated material or obstruction.

G. Samples of the weathered limestone at trench bottom shall be taken with excavation equipment at the Owner's request to demonstrate suitable closure has been provided.

H. Bottom soundings and samples shall be taken and documented to demonstrate that the trench bottom is clear of sand sediment before backfill is placed to cover the bottom.

I. Corner excavation details shall not extend more than 10 ft beyond the barrier alignment shown. Initial lead-in slopes shall be 1V:1 H or flatter.

J. Cross-cut closures shall extend a minimum of 5 ft beyond the barrier centerline at the bottom of the excavation.

K. Overlap closures shall extend 10 ft minimum beyond the previously approved final bottom. Backfill shall be removed to clear the bottom for measurement. Installation of sheeting or end stop pipe to limit removal, if desired, shall be performed in a manner approved by the Owner.

L. Excavation spoils, Soil Blend, and Prepared Backfill shall be stored and stockpiled to minimize ponding or collection of rainfall, and to prevent erosion or cross-mixing.

3.06 TRENCH STABILITY

A. Furnish and maintain all labor, equipment, materials, and supplies necessary for the preparation, mixing, hydration, storage, transportation, circulation, cleaning, desanding, Quality Control testing, chemical testing, maintenance, and disposal of bentonite slurry to provide the stability of the open slurry trench at all times for its full depth.

B. Slurry trenches shall be filled and maintained with a stable suspension of bentonite slurry. Slurry level shall be maintained within two feet of the workplatform surface at all times during excavation. Slurry levels shall be raised to within 0.5 ft of the workplatform surface before excavation work stoppages of 8 hours or more.

C. Maintain the slurry properties within the specified limits. Trench slurry shall be maintained by removing old slurry from the trench and replacing with fresh slurry, circulating and cleaning trench slurry to remove coarse material throughout its depth, or use of chemical additives.

D. Excavation and backfill mixing equipment shall be operated outside the area influencing slurry trench stability as described below where D is the depth of the open slurry-filled-trench below the work platform at the location in question.

1. Equipment shall not straddle the open slurry trench.

2. Track equipment for clamshell excavation shall not be permitted to operate closer than 14 ft from the side of the open slurry trench. Multiple clamshell operations shall be separated by D/2, or more, along the trench length.

3. No equipment loading, spoils placement, or backfill preparation will be permitted within 5 ft of the open slurry trench.

4. Backfill mixing may not take place within D/2 of the open slurry trench. Mixing equipment shall operate perpendicular to the trench in this zone to move excavation spoils.

5. Excavation spoil deposits shall be limited to an average thickness of 1 ft within D/2 of the open trench.

6. The toe of waste excavation spoil stockpiles shall be placed more than 2D/3 from the slurry trench. Stockpile slopes shall be 1V:2H or flatter, and stockpiles shall be no higher than 10 feet above the ground surface.

E. If slurry trench walls cave, slide, or slough, the Contractor shall, at no additional expense, re-excavate the trench to remove all material displaced and all backfill contaminated with soil. The reason for trench instability shall be investigated by the Contractor and the Owner. The Contractor shall revise methods, equipment, and materials, and take approved corrective action to prevent further deterioration of the affected area, and to prevent future trench wall instability.

3.07 QUALITY CONTROL OF BENTONITE SLURRY

A. Fresh bentonite slurry shall be tested at least twice daily when mixing and once daily when not mixing to demonstrate compliance with requirements of Part 2. Submit test results daily.

B. Bottom samples of trench slurry shall be sampled and tested twice daily, and top slurry samples shall be sampled once daily, to demonstrate compliance with requirements of Part 2. Submit test results daily.

C. The Contractor shall notify the Owner and investigate and correct slurry deficiencies immediately upon discovery.

3.08 TOLERANCES

A. Trench walls shall be vertical, within 2% of wall depth. The excavator shall be leveled to provide a vertical trench. The Contractor shall demonstrate the excavation equipment is level.

B. The barrier centerline shall be within two feet of the design alignment at any location. Alignment changes necessary to accomplish turns or to bypass obstructions, utilities, structures, etc., may be made only with the approval of the Owner, and shall be documented by survey.

C. If for any reason the excavation method begins to result in a trench width greater than twice the specified width at any depth, or begins to result in misalignment of the trench, the Contractor shall cease trench excavation and revise procedures and equipment to prevent further enlargement or trench misalignment.

3.09 BOTTOM MEASUREMENT AND SAMPLING

A. Reference elevations for determining bottom elevations shall be surveyed and staked in the field at each 10 ft construction stations where bottom measurements are taken. A string line or offset grade stakes shall be established within 3 ft of the trench walls for depth measurement reference. Reference elevations shall be checked and re-established by survey periodically and when requested.

B. Sediment thickness at the bottom of the trench shall be defined as the difference in bottom depth measurements using the flat weight and the pointed weight at the same construction station. The pointed weight shall be advanced to within 0.25 ft of the sounding taken after final excavation, or deeper, when measuring sediment thickness.

C. Sediment thickness shall be determined at 10 ft construction stations after cleaning sediment and immediately before backfill placement.

D. The pointed and flat weights shall be lowered plumb and extracted between readings; at depths below 40 ft, these tools cannot be pulled plumb within viscous trench slurry.

E. When the Contractor believes that bedrock has been encountered, the Contractor shall notify the Owner and measure the depth of the trench and determine the top of rock elevation. Depth may be measured using the clamshell depth gage. Depths shall be measured at 10 ft spacing. The bedrock surface shall be sampled with the clamshell, or other suitable sampling device, at the Owner's request. Bottom materials will be evaluated by the Owner. The Owner will determine if the top of bedrock has been encountered.

F. The Contractor shall remove weathered rock with the clamshell excavator, at the direction of the Owner. Chiseling will not be employed. The Owner will determine the bottom of excavation.

When the excavation is complete, the Contractor shall measure the depth of the trench and determine the trench bottom elevation. Depth may be measured using the clamshell depth gage. Depths shall be measured at 10 ft spacing, at same construction stations as above.

G. The elevation of the trench bottom shall be determined daily, before excavating, at 20 ft spacing within 100 ft each side of the backfill toe and at 60 ft spacing beyond, for the full length of the slurry-supported trench.

H. Sediment thickness shall be determined at 10 ft spacing along the prepared bottom before the bottom is covered with backfill. Pointed weight depths may be used for final depth documentation if sediment is determined to meet the criteria of Part 3.10.

I. The backfill surface shall be sampled with a split spoon sampler or grab sampler at a minimum of three locations, in the presence of the Owner, daily before placing backfill, to determine if the backfill surface must be cleaned.

J. The Contractor shall verify trench bottom and backfill surface depth and elevation, sediment thickness, and reference elevations when requested.

3.10 BOTTOM CLEANING

A. The exposed bottom of the slurry-filled trench shall be cleaned of all loose material daily prior to backfill placement.

B. The toe of the backfill slope shall be excavated every 100 ft of advance to remove accumulated soft materials pushed ahead of the backfill. Cleaning may be performed by any combination of an extended reach backhoe, clamshell, airlifts, suction pumps, etc. Cleaning spoils may be used for preparation of Backfill.

C. If the pointed weight cannot be advanced to within 0.25 ft of the recorded maximum bottom depth when measuring sediment thickness, the bottom shall be cleaned of sediment before backfill is placed.

D. If more than 0.5 ft of sediment is measured on the bottom, the bottom shall be cleaned of sediment before backfill is placed.

E. If any split spoon sample taken from the backfill surface contains more than 0.25 ft (3 inches) of sand sediment, sand-laden bentonite, or material other than prepared backfill, the backfill surface shall be cleaned before backfill is placed.

3.11 BACKFILL PREPARATION

A. Backfill material may be mixed adjacent to the trench or at a remote mixing area approved by the Owner. After clearing and grubbing, remote backfill mixing areas shall be prepared by placing a compacted layer of soil suitable for inclusion within the backfill. Backfill mixing surfaces shall be reconstructed with borrow fill to prevent incorporating underlying soil into the backfill.

B. Segregation and stockpiling of excavation spoils shall be performed as required to obtain the specified backfill gradation with the minimum addition of imported fill. Use of imported soil to augment the Soil Blend shall be approved by the Owner.

C. Soil clods shall be reduced in size to one-quarter inch (1/4 inch) or less. Some spoils may require special mechanical shredding. Cemented soil or rock shall be reduced to gravel sizes meeting the backfill gradation, or shall be removed from the backfill. Cemented particles which survive standard gradation testing methods need not be broken down further.

D. Slurry shall be added to the backfill to control slump. Addition of storm water is prohibited. Test slump immediately before placing backfill.

E. Dry bentonite, if required, shall be added to the Prepared Backfill by dry weight of Soil Blend. Up to 2% dry bentonite may be added to reduce slump, if required.

F. Other than the addition of slurry or dry bentonite to adjust the slump, no soil or gravel may be added after samples for laboratory testing are taken. Mixing may continue.

G. Backfill shall be placed at the slump required in Part 2.

H. Frozen backfill shall not be placed in the trench. Backfill mixing and placement shall cease at temperatures below 30°F or when, in the opinion of the Owner, adverse weather conditions do not permit proper mixing.

I. Back-blading shall be used where possible to prevent overexcavation and inclusion of unmixed soils with prepared backfill.

3.12 BACKFILL PLACEMENT

A. Trench bottom and backfill slope shall be measured, sampled, cleaned if required, and approved by the Owner immediately before backfill placement.

B. All backfill Quality Control tests shall be completed and backfill shall meet the specification requirements before it may be placed.

C. Initially, the S-B backfill shall be placed into the trench at one location only, by clamshell, tremie, or on a lead-in slope, until backfill emerges from the slurry surface and has achieved a natural angle of repose extending to the trench bottom.

D. Free dropping of backfill through slurry will not be permitted. Backfill shall be placed on the surface of previously placed backfill, no closer than 5 ft from the point at which the backfill enters the slurry surface. Backfill shall be placed in such a manner that the backfill displaces the slurry and intermixing of the backfill and slurry does not occur.

E. In order to promote mudwave type displacement of slurry and sediment in the trench, backfill shall be placed at a single location until the backfill slope fails to advance with additional backfill placement.

F. Backfill placement method shall not splash backfill or slurry outside the top of the trench.

G. The toe of the advancing backfill slope shall be a minimum of 40 ft and a maximum of 100 ft from the closest point of excavation. The toe of the backfill slope shall be established to prevent cross contamination of the backfill by excavation spoils.

H. The trench shall be backfilled to within 6 inches of the work platform but no higher than the work platform.

I. The toe of the backfill material that rises to the top of trench at the terminal end shall be re-excavated as necessary to remove entrapped slurry, silt, sediment, and sand that may exist. This material shall be replaced with new prepared backfill.

J. Settlement Monitoring of Completed Backfill:

1. Settlement plates illustrated on the Contract Drawings shall be installed 18" below the surface of the completed trench backfill at 200 ft spacing along the barrier within 24 hours of completion of backfilling within 50 ft of the plate location. A PVC sleeve shall be installed over the riser to separate the riser from the soil-bentonite backfill outside of the sleeve. The elevation of the top of each settlement platform riser pipe shall be determined immediately after installation, then daily thereafter until the Owner indicates that cap construction may begin. Settlement plate readings shall be provided to the Owner in the daily quality control report. Settlement plates shall be removed during cap construction.

3.13 QUALITY CONTROL OF PREPARED BACKFILL

A. Sample selection, labeling and packing.

1. Samples of Prepared Backfill shall be taken in the presence of the Owner. Samples shall be acquired from the mixing area, the completed trench, or as directed by the Owner.

2. Record Backfill samples shall be clearly labeled with sample number, batch, mix location, and date and time sampled. If samples are acquired from the trench, sampling station and elevation shall be recorded.

3. Quality assurance samples shall be split for Owner and Contractor use. The Contractor shall ship two 20 lb samples of Prepared Backfill to the Owner's Quality Assurance testing facility by overnight express each week during the project, or when directed.

B. Testing Schedule for Prepared Backfill:

1. The minimum number of Quality Control tests performed by the Contractor shall be as described below. Testing does not need to be performed if backfill mixing is not

occurring. The Contractor shall perform additional tests to confirm mix proportions and bentonite addition, etc., or as directed by the Owner:

Test	Volume of Prepared Backfill
Gradation	800 cy or 1 per day min
Bulk Wet Density	300 cy or 2 per day min
Water Content	300 cy or 2 per day min
Slump	300 cy or 2 per day min
Permeability	1,200 cy or 1 per week min

2. Bulk wet density of the backfill shall be measured using a standard 1/10 cubic ft mold of known weight, screeding off the excess, and cleaning and weighing the filled mold. The test specimens shall be placed in the mold in three lifts, rodding each lift 25 times.

C. The Owner's laboratory will provide Quality Assurance permeability testing of Prepared Backfill. One QA test shall be performed for every 3,000 cy of backfill prepared and placed.

D. Permeability samples shall be scalped in the lab to remove particles larger than the 3/8 inch sieve. Permeability test specimens shall be isotopically consolidated to an effective stress of 15 psi, with a total cell pressure of 50 psi or higher. Laboratory tap water shall be used to define permeability.

3.14 STABILIZATION AND PLACEMENT OF BARRIER CONSTRUCTION BYPRODUCTS

A. Excess backfill hall be used to temporarily cover the completed Hydraulic Barrier. Wet spoils remaining after cover soil use shall be stabilized by desiccation or by the thorough addition of cement (2% to 3% by dry weight of spoils). Spoils shall be stabilized to allow handling and compaction by earthwork equipment.

B. At completion of slurry trench excavation and backfill, waste slurry shall be stabilized by evaporation, addition of cement, or addition of other stabilizing material for controlled disposal on site. Slurry shall be stabilized to meet the requirements of General Fill. Slurry ponds shall be emptied and leveled after slurry stabilization. Slurry shall not be discharged into any sanitary sewer, storm sewer, or natural drainage channel.

C. Waste slurry shall be treated and dried or stabilized by cement addition before the contractor demobilizes.

D. Stabilized waste materials shall be left on site at an area designated by the Owner.

E. Grade spoils piles to promote storm water runoff towards appropriate draining systems.

3.15 SITE CLEAN-UP AND CAP OVER BARRIER

A. Construct cap over barrier as illustrated on Contract Drawings. Imported clay fill used for cap construction shall be approved by the Owner. Place reinforcement grid to separate clay fill cap from soil-bentonite backfill. Re-establish drainage swales to original grades, place topsoil and seed over areas affected by the work.

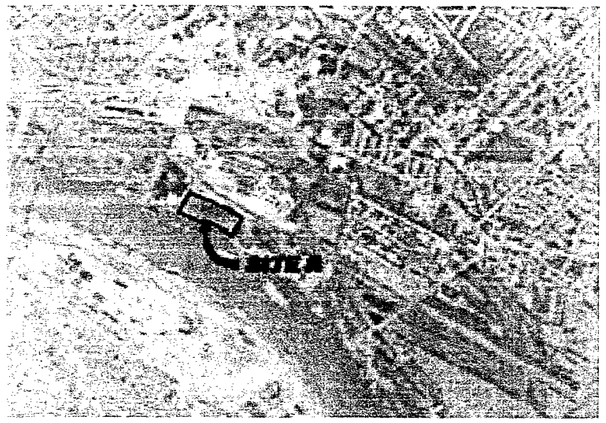
B. Remove or shape the Work Platform and clean slurry trench and backfill mixing work surfaces and adjacent ground to restore original grade. Scrape work surfaces clean of excavation spoils, soils containing bentonite, siltation, and softened surface soils. Slurry tanks, temporary roads or other earthwork, ditches, drainage culverts, etc. shall be filled and left in a condition acceptable to the Owner. Grade work areas to promote storm water runoff. Spoils resulting from cleaning shall be placed on site in a controlled manner where designated by the Owner.

- END OF SECTION -

DEEP SOIL–BENTONITE BARRIER
SOLUTIA, INC.
SAUGET, ILLINOIS

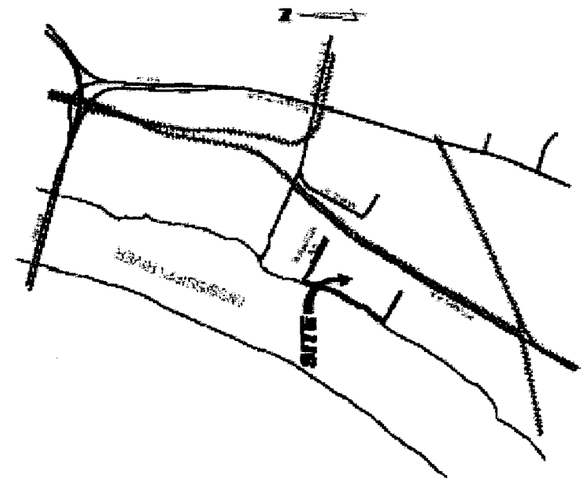
Inquip Associates, Inc.

SOLUTIA™
Applied Chemistry, Creative Solutions



CONTRACT DRAWINGS

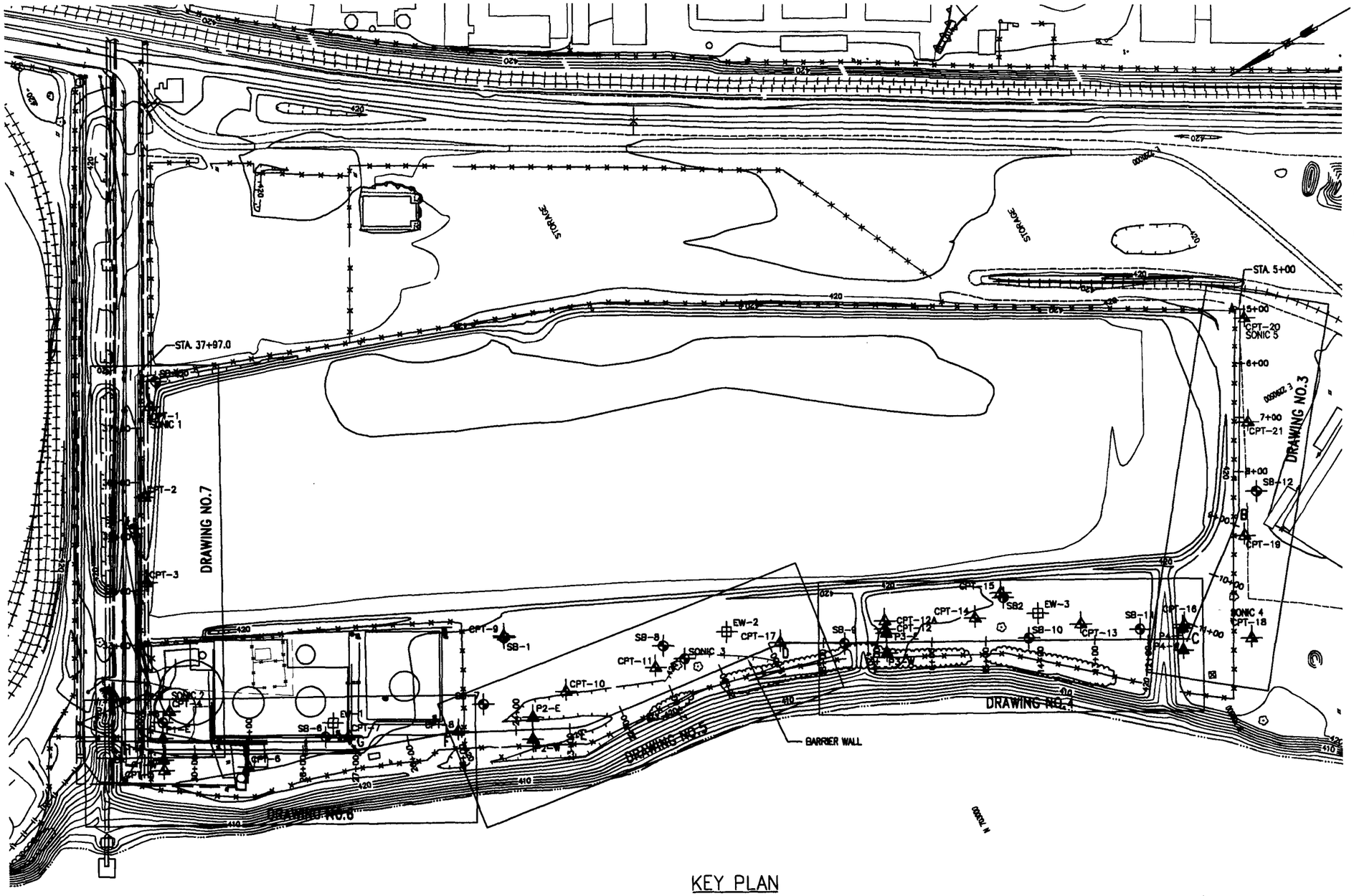
DRAWING NO.	FILE NAME	TITLE
1	1	TITLE SHEET
2	2	KEY PLAN
3	3	BARRIER PLAN AND PROFILE, STA. 5+00 TO STA. 11+27.5
4	4	BARRIER PLAN AND PROFILE, STA. 11+27.5 TO STA. 18+00
5	5	BARRIER PLAN AND PROFILE, STA. 18+00 TO STA. 25+00
6	6	BARRIER PLAN AND PROFILE, STA. 25+00 TO STA. 31+8.78
7	7	BARRIER PLAN AND PROFILE, STA. 31+8.78 TO STA. 37+96.51
8	8	CONTROL POINTS
9	9	CAP DETAILS
10	10	BACKFILL SETTLEMENT MONITORING



LOCATION MAP

PRELIMINARY
09–16–03

SOLUTIA, INC SITE R SAUGET — ILLINOIS		
INQUIP ASSOCIATES, INC McLEAN — VIRGINA		
MUESER RUTLEDGE CONSULTING ENGINEERS 14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122		
SCALE N.T.S.	MADE BY E.C. DATE 08–14–03 CHKD BY K.R. DATE 08–14–03	FILE NO. 10060
TITLE SHEET		DRAWING NO. 1



NOTES:

1. Base plan and graphic boring logs were taken from July 03, 2003 AutoCAD files provided by URS.
2. Graphic logs depict generalized soil conditions. Refer to individual boring log records for details.
3. Borings are projected to section. Actual elevation of the bedrock surface may vary.
4. Overhead and subsurface obstructions are not shown.
5. Lead-in slope to be located by the contractor. Lead-in slope shall be 1V:1H or flatter.
6. Overlap closures shall extend 10 ft beyond the toe of the lead-in slope at the bottom of the trench.
7. Cross-cut closures shall extend 5 ft beyond the outside edge of the cutoff at the bottom of the trench.
8. Contractor shall construct the final barrier alignment within 2 ft of the centerline given by the Control Points provided on Drawing 8.
9. Contractor's Surveyor shall establish the construction stations shown with stakes at 10 ft intervals. Construction station markers shall remain in place at 10 ft intervals throughout construction. Construction station markers shall remain in place at 100 ft intervals after cap construction.
10. Contractor's Surveyor shall establish reference elevations for trench depth measurements at each 10 ft construction station.
11. Control Points A through I provided on Drawing 8 shall be identified in the field. Other control points may be required.
12. The contractor is responsible for maintaining trench stability and construction quality.
13. Work platform surface elevation grades may change + 1% within 200 ft distance, but must not drop more than −0.1% over 1400 ft.
14. Typical freeboard (slurry level to work platform surface) shall be 1 ft or less. Maximum freeboard permitted is 2 ft.
15. Contractor shall mark and protect wells and piezometers.
16. See URS Drawing No.s 2-06, 2-07, and 2-08 for utilities.

KEY PLAN

GRAPHIC SCALE

100' 50' 0 100' 200'

LEGEND

- CPT – CONE PENETROMETER LOCATION (2001)
- SONIC – SONIC BORING LOCATION (2002)
- SB – STANDARD PENETRATION TEST BORING (2001 AND 2002)

PRELIMINARY
09-16-03

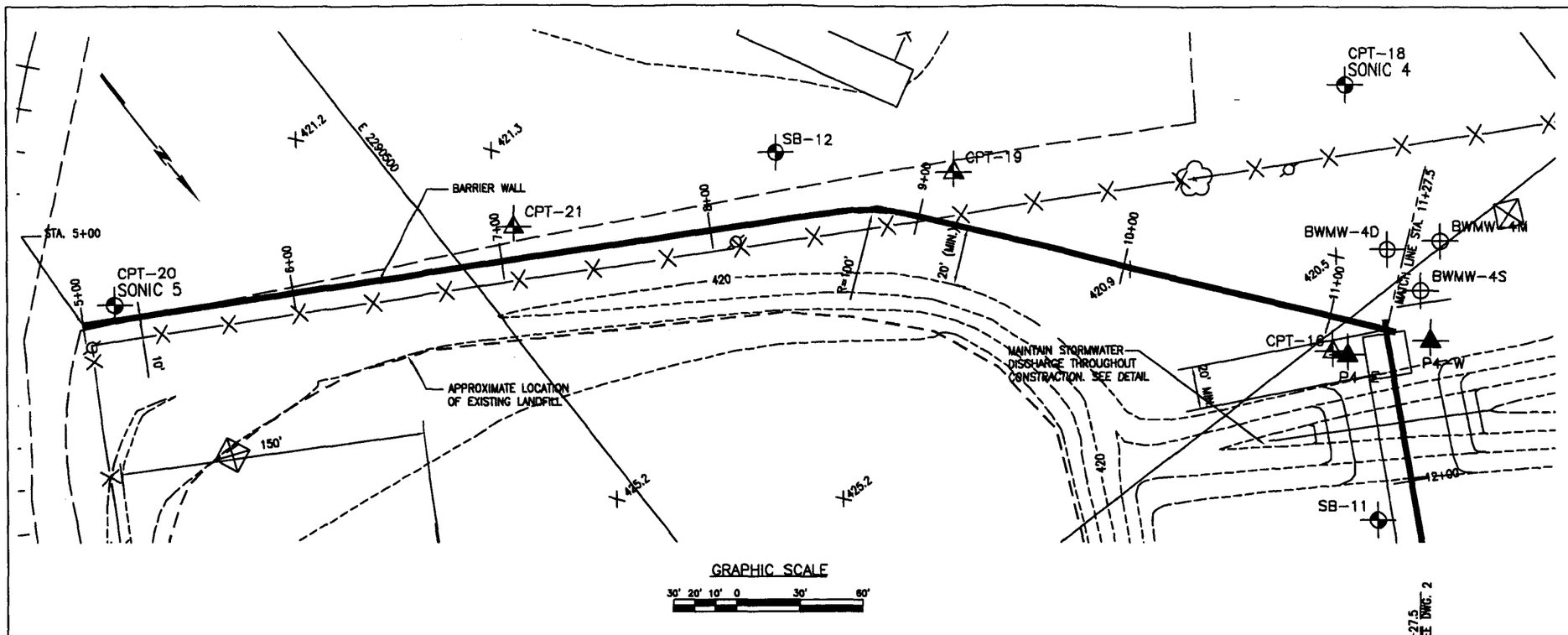
SOLUTIA, INC
SITE R
SAUGET ILLINOIS

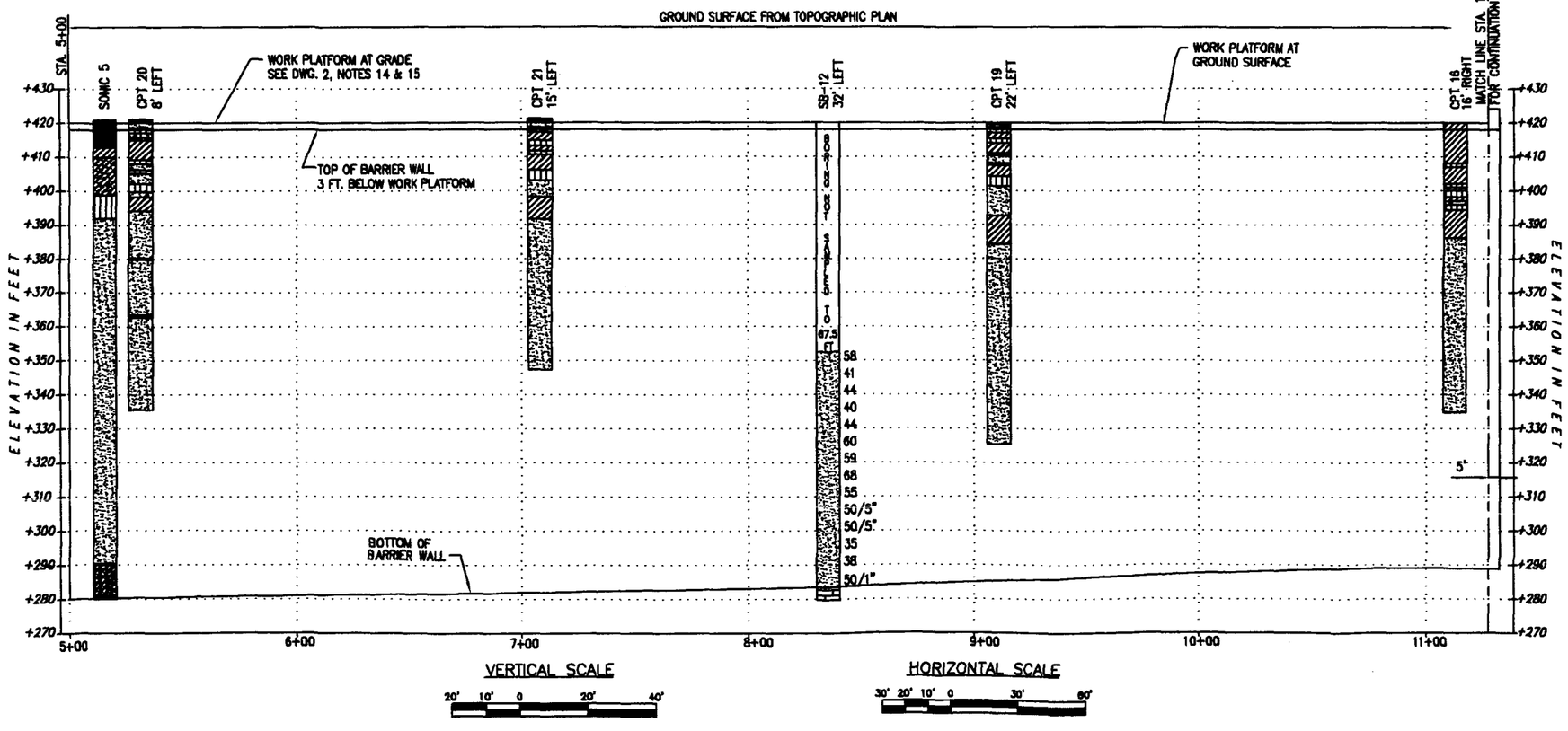
INQUIP ASSOCIATES, INC
McLEAN VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C	DATE 8-11-03	FILE NO.
AS NOTED	CH'KD BY K.R.	DATE 8-11-03	10060

KEY PLAN — DRAWING NO. 2





PLAN LEGEND

62	STANDARD PENETRATION TEST BLOW COUNT (N). BLOWS /12" PENETRATION OF SAMPLER UNLESS INDICATED OTHERWISE
P	HYDRAULICALLY PUSHED SAMPLE
10+00	WALL STATION AT CENTERLINE OF BARRIER WALL
CPT-1	CONE PENETROMETER TEST NUMBER (2001)
SONIC 1	SONIC BORING NUMBER (2002)
SB-1	SOIL BORING NUMBER (2002)

PROFILE LEGEND

- CLAY (CL OR CH)
- SILT (ML)
- CLAYEY SAND (SC)
- SAND (SP OR SW)
- GRAVEL AND/OR COBBLES
- LIMESTONE
- PROPOSED SCREENED INTERVAL OF EXTRACTION WELL OR PIEZOMETER

NOTES:

1. For notes, see Drawing No. 2.

PRELIMINARY
09-16-03

SOLUTIA, INC
SITE R
SAUGET ILLINOIS

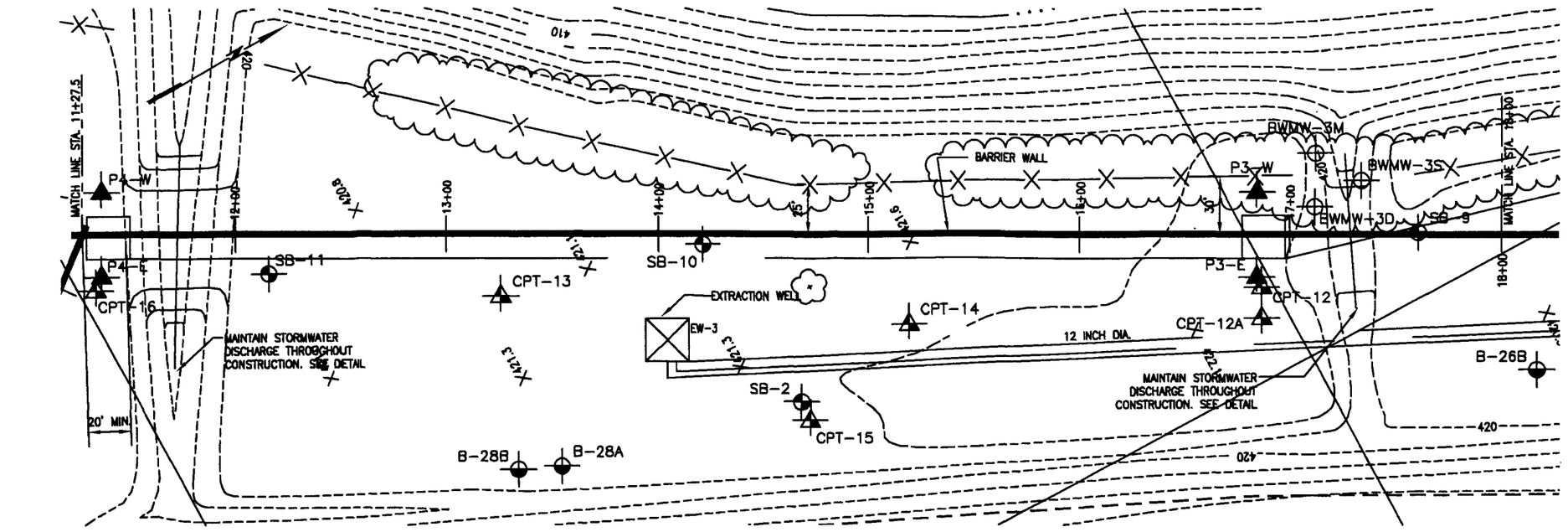
INQUIP ASSOCIATES, INC
McLEAN VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C.	DATE 8-07-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-07-03	10060

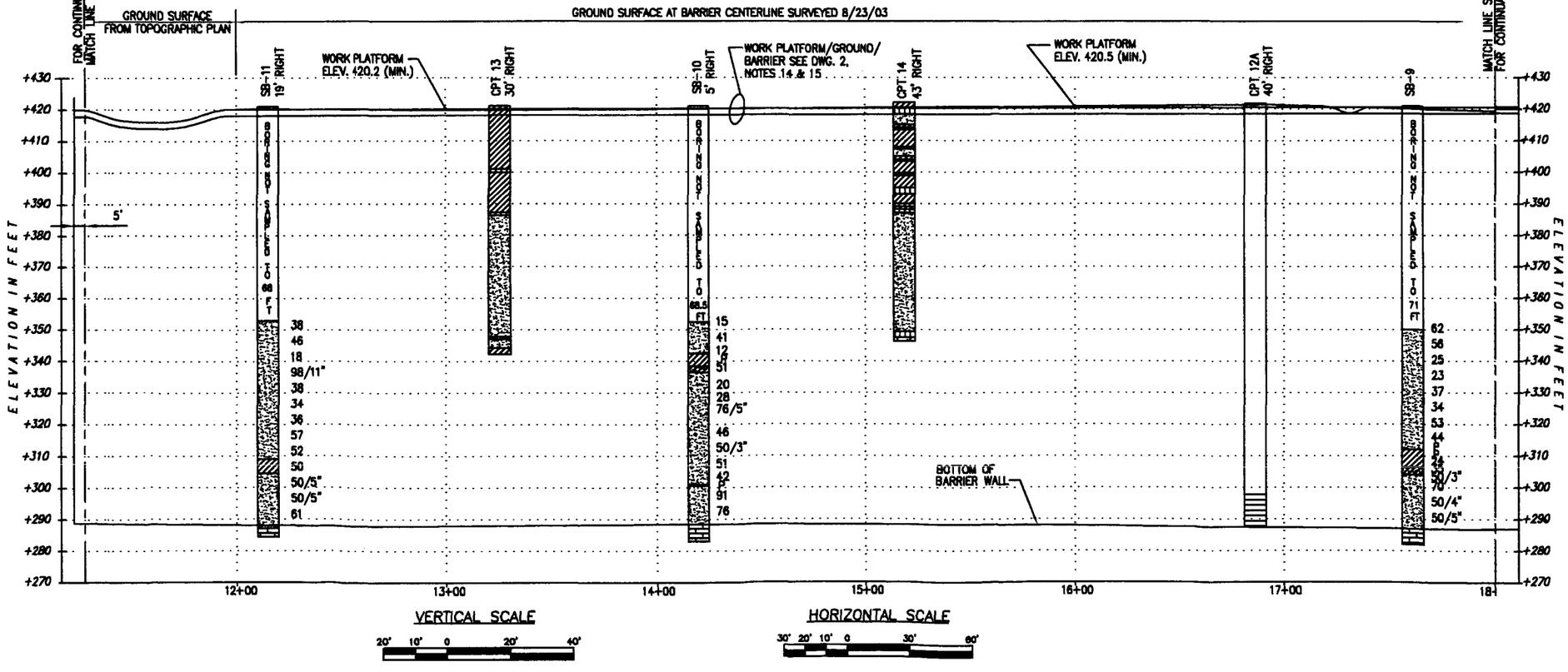
BARRIER PLAN AND PROFILE, STA. 5+00 TO 11+27.5

DRAWING NO. 3



GRAPHIC SCALE

30' 20' 10' 0 30' 60'



VERTICAL SCALE

20' 10' 0 20' 40'

HORIZONTAL SCALE

30' 20' 10' 0 30' 60'

PLAN LEGEND

62	STANDARD PENETRATION TEST BLOW COUNT (N). BLOWS /12" PENETRATION OF SAMPLER UNLESS INDICATED OTHERWISE
P	HYDRAULICALLY PUSHED SAMPLE
10+00	WALL STATION AT CENTERLINE OF BARRIER WALL
CPT-1	CONE PENETROMETER TEST NUMBER (2001)
SONIC 1	SONIC BORING NUMBER (2002)
SB-1	SOIL BORING NUMBER (2002)

PROFILE LEGEND

- CLAY (CL OR CH)
- SILT (ML)
- CLAYEY SAND (SC)
- SAND (SP OR SW)
- GRAVEL AND/OR COBBLES
- LIMESTONE
- PROPOSED SCREENED INTERVAL OF EXTRACTION WELL OR PIEZOMETER

NOTES:

1. For notes, see Drawing No. 2.

PRELIMINARY
09-16-03

SOLUTIA, INC
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SAUGET ILLINOIS

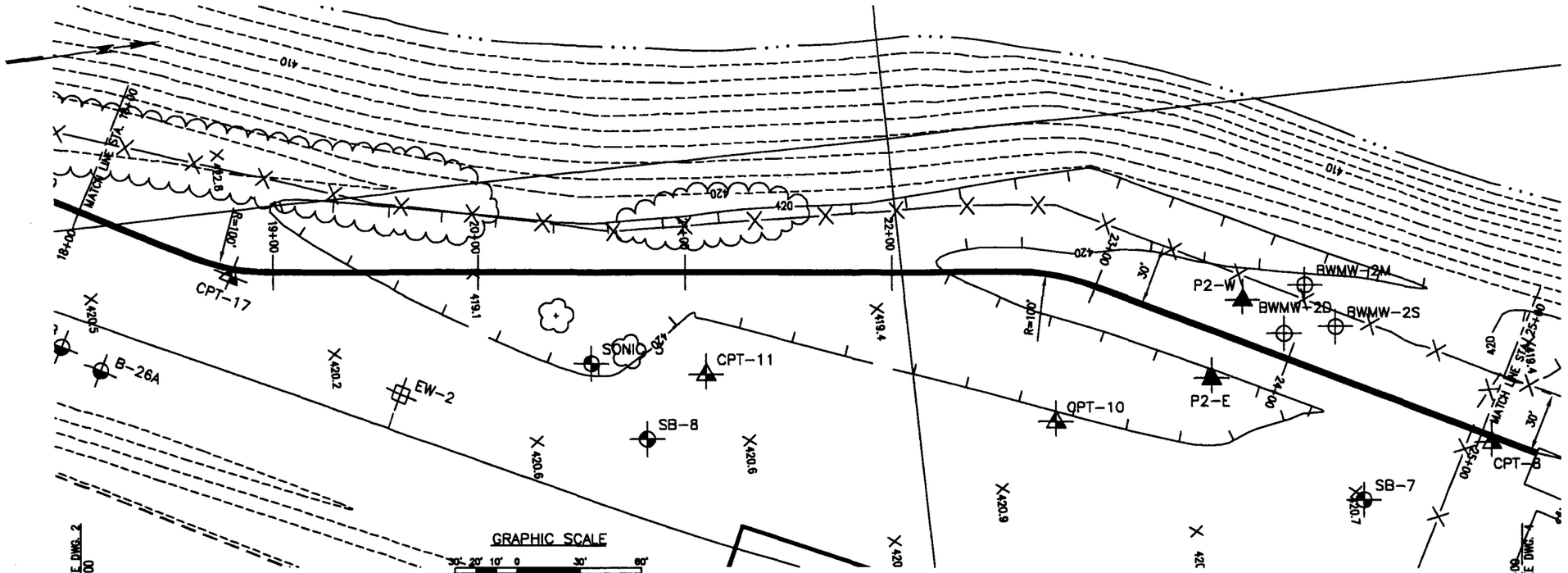
INQUIP ASSOCIATES, INC
McLEAN VIRGINA

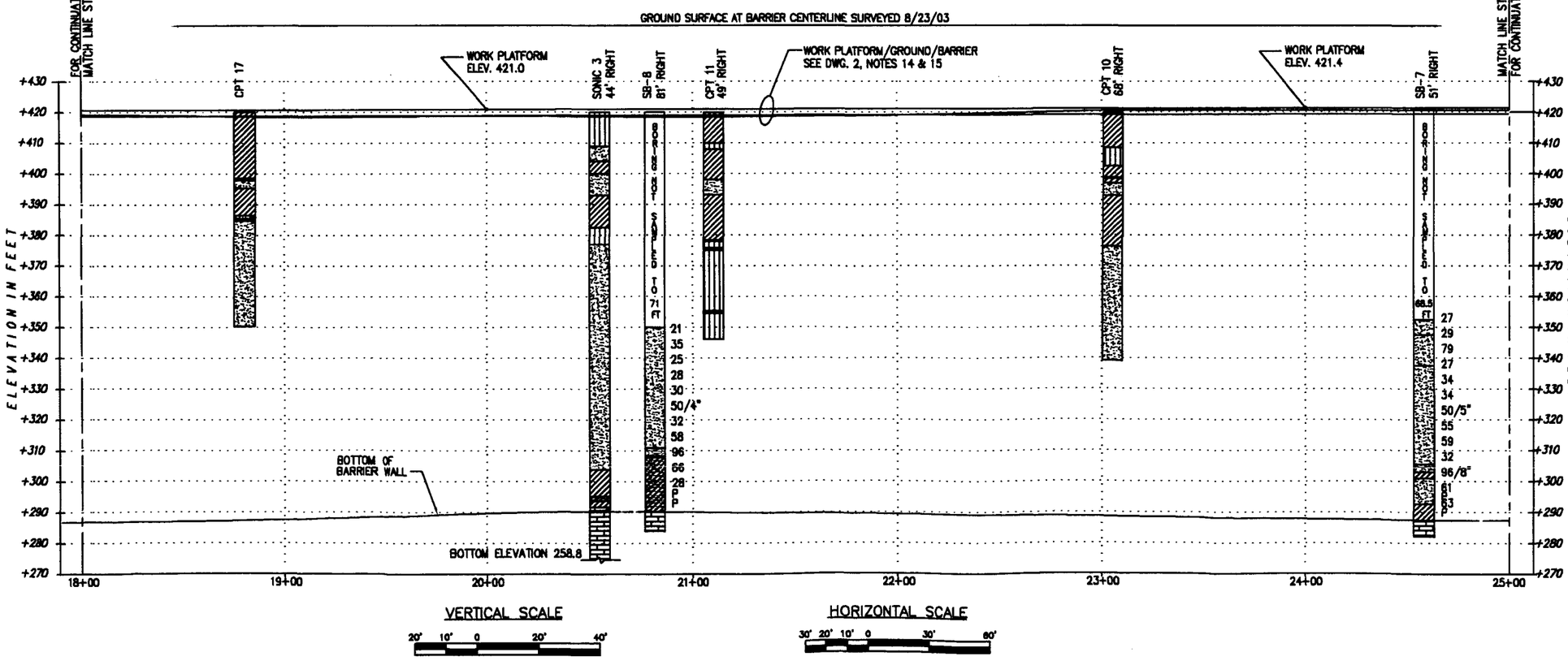
MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C.	DATE 8-07-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-07-03	10060

BARRIER PLAN AND PROFILE, STA. 11+27.5 TO STA. 18+00

DRAWING NO. 4





PLAN LEGEND

62	STANDARD PENETRATION TEST BLOW COUNT (N). BLOWS /12" PENETRATION OF SAMPLER UNLESS INDICATED OTHERWISE
P	HYDRAULICALLY PUSHED SAMPLE
10+00	WALL STATION AT CENTERLINE OF BARRIER WALL
CPT-1	CONE PENETROMETER TEST NUMBER (2001)
SONIC 1	SONIC BORING NUMBER (2002)
SB-1	SOIL BORING NUMBER (2002)

PROFILE LEGEND

- CLAY (CL OR CH)
- SILT (ML)
- CLAYEY SAND (SC)
- SAND (SP OR SW)
- GRAVEL AND/OR COBBLES
- LIMESTONE
- PROPOSED SCREENED INTERVAL OF EXTRACTION WELL OR PIEZOMETER

NOTES:

1. For notes, see Drawing No. 2.

PRELIMINARY
09-16-03

SOLUTIA, INC
SITE R
SAUGET ILLINOIS

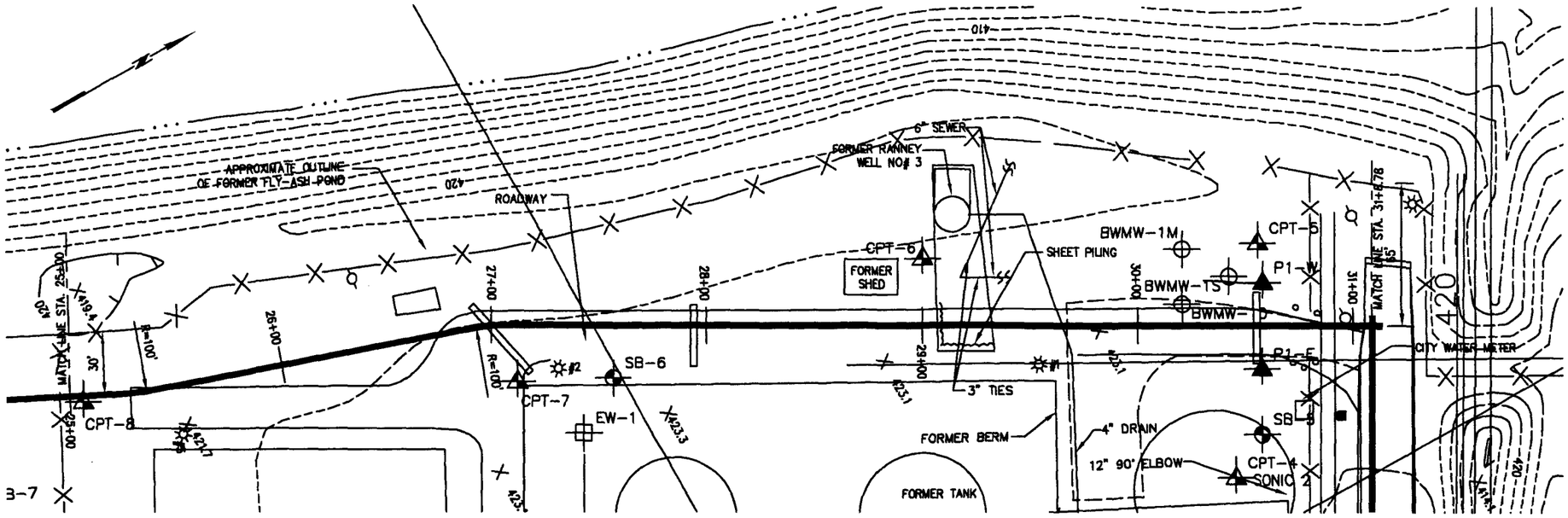
INQUIP ASSOCIATES, INC
McLEAN VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C.	DATE 8-07-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-07-03	10060

BARRIER PLAN AND PROFILE, STA. 18+00 TO STA. 25+00

DRAWING NO. 5



GRAPHIC SCALE

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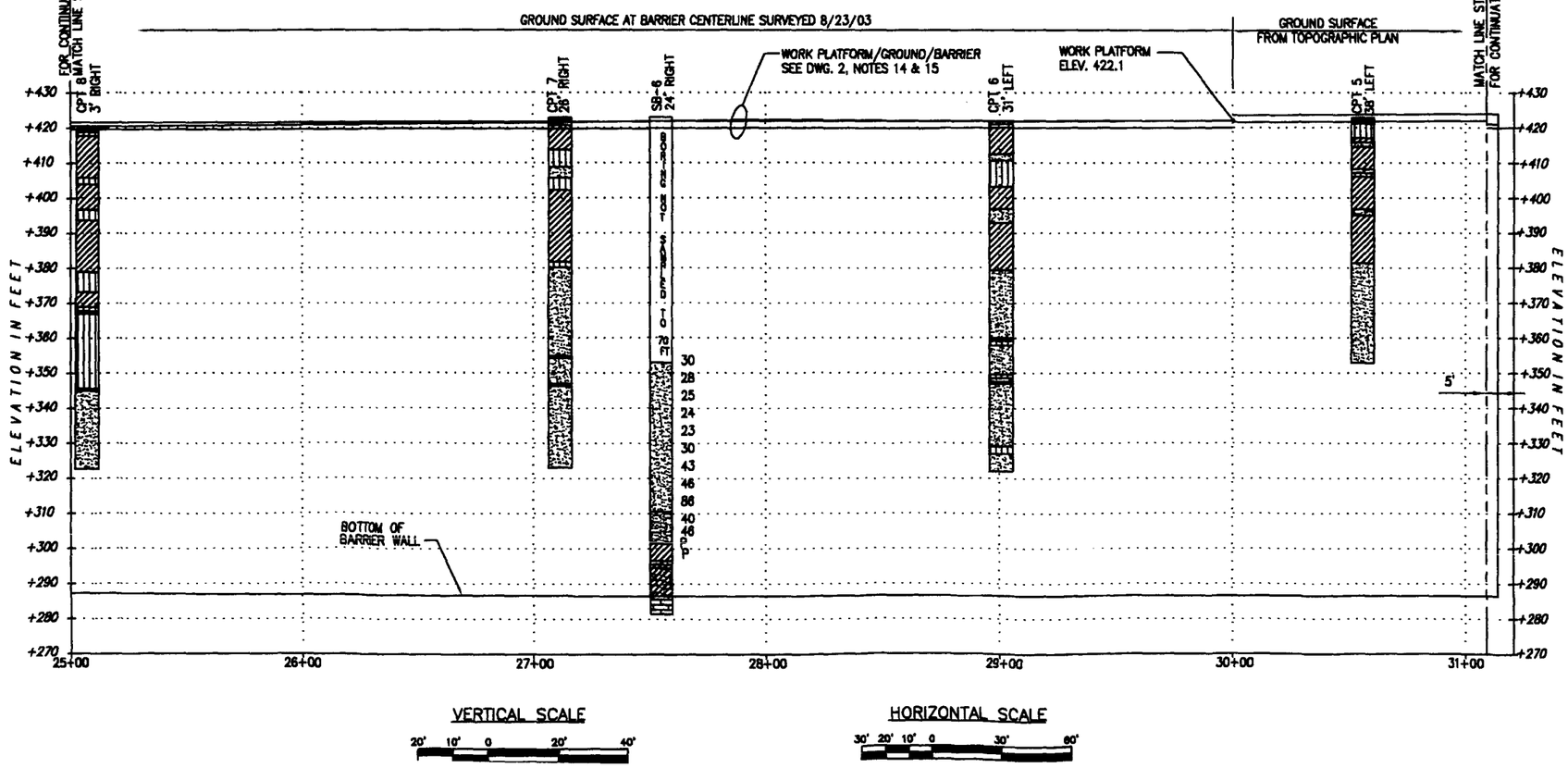


VERTICAL SCALE

20' 10' 0 20' 40'

HORIZONTAL SCALE

30' 20' 10' 0 30' 60'

PLAN LEGEND

62	STANDARD PENETRATION TEST BLOW COUNT (N). BLOWS /12" PENETRATION OF SAMPLER UNLESS INDICATED OTHERWISE
P	HYDRAULICALLY PUSHED SAMPLE
10+00	WALL STATION AT CENTERLINE OF BARRIER WALL
CPT-1	CONE PENETROMETER TEST NUMBER (2001)
SONIC 1	SONIC BORING NUMBER (2002)
SB-1	SOIL BORING NUMBER (2002)

PROFILE LEGEND

- CLAY (CL OR CH)
- SILT (ML)
- CLAYEY SAND (SC)
- SAND (SP OR SW)
- GRAVEL AND/OR COBBLES
- LIMESTONE
- PROPOSED SCREENED INTERVAL OF EXTRACTION WELL OR PIEZOMETER

NOTES:

1. For notes, see Drawing No. 2.

PRELIMINARY
09-16-03

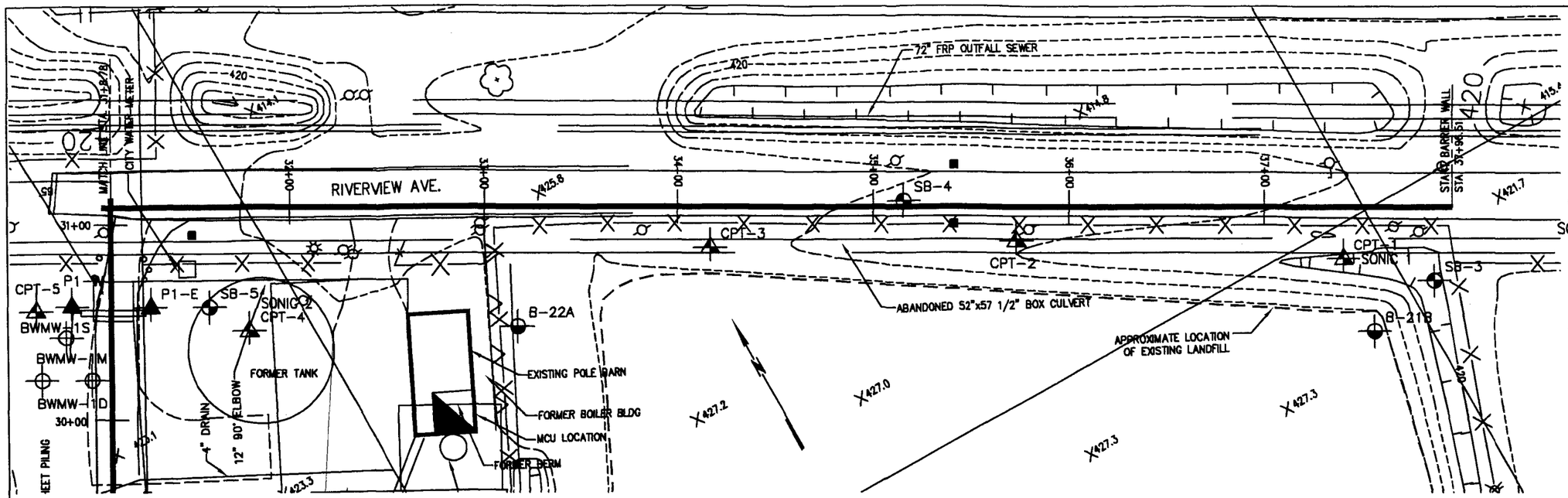
SOLUTIA, INC
SITE R
SAUGET — ILLINOIS

INQUIP ASSOCIATES, INC
McLEAN — VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C.	DATE 8-07-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-07-03	10060

BARRIER PLAN AND PROFILE, STA. 25+00 TO STA. 31+8.78 — DRAWING NO. 6



GRAPHIC SCALE

30' 20' 10' 0 30' 60'

PLAN LEGEND

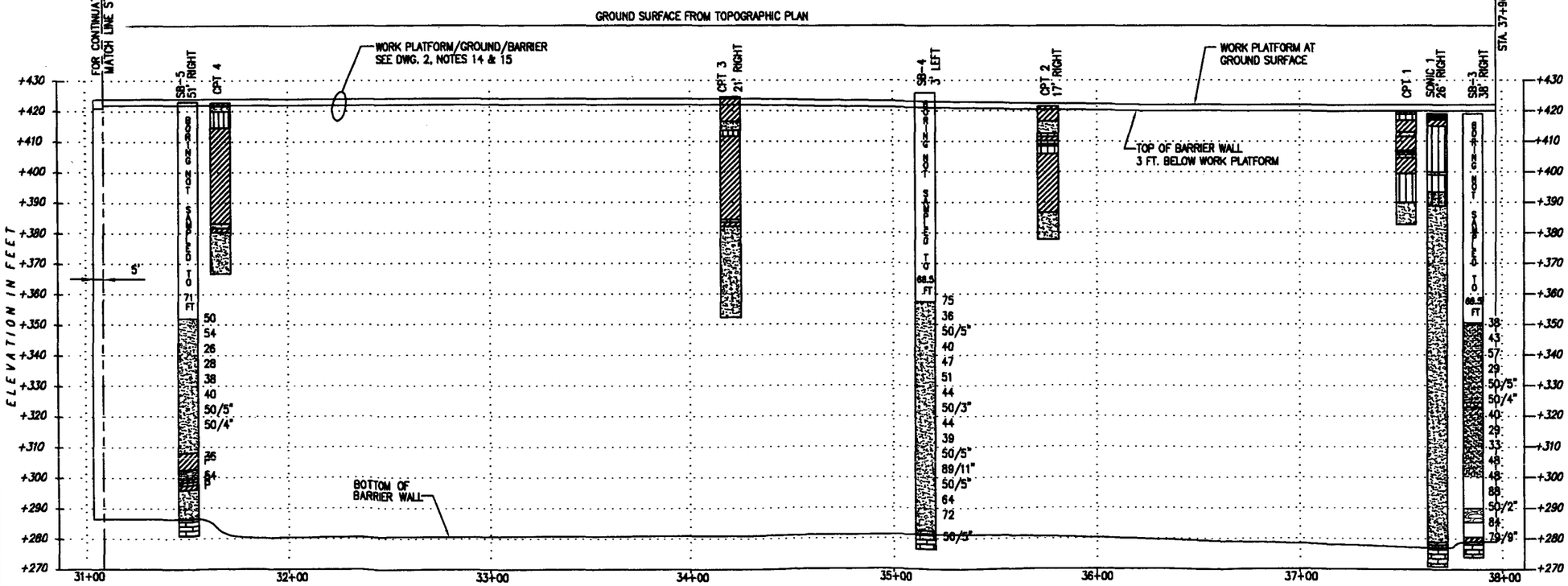
62	STANDARD PENETRATION TEST BLOW COUNT (N). BLOWS /12" PENETRATION OF SAMPLER UNLESS INDICATED OTHERWISE
P	HYDRAULICALLY PUSHED SAMPLE
10+00	WALL STATION AT CENTERLINE OF BARRIER WALL
CPT-1	CONE PENETROMETER TEST NUMBER (2001)
SONIC 1	SONIC BORING NUMBER (2002)
SB-1	SOIL BORING NUMBER (2002)

PROFILE LEGEND

- CLAY (CL OR CH)
- SILT (ML)
- CLAYEY SAND (SC)
- SAND (SP OR SW)
- GRAVEL AND/OR COBBLES
- LIMESTONE
- PROPOSED SCREENED INTERVAL OF EXTRACTION WELL OR PIEZOMETER

NOTES:

1. For notes, see Drawing No. 2.



VERTICAL SCALE

20' 10' 0 20' 40'

HORIZONTAL SCALE

30' 20' 10' 0 30' 60'

PRELIMINARY
09-16-03

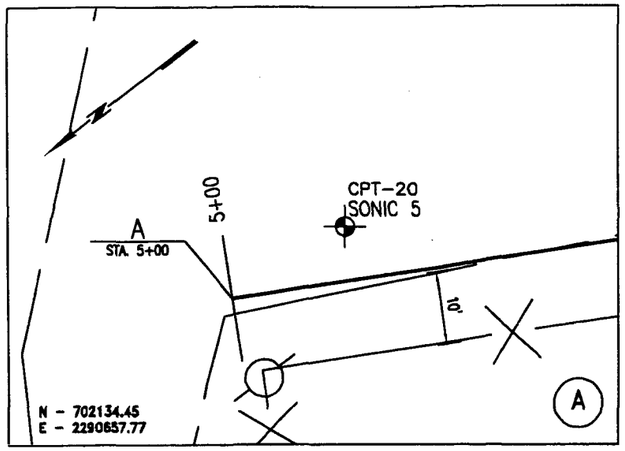
SOLUTIA, INC
SITE R
SAUGET ILLINOIS

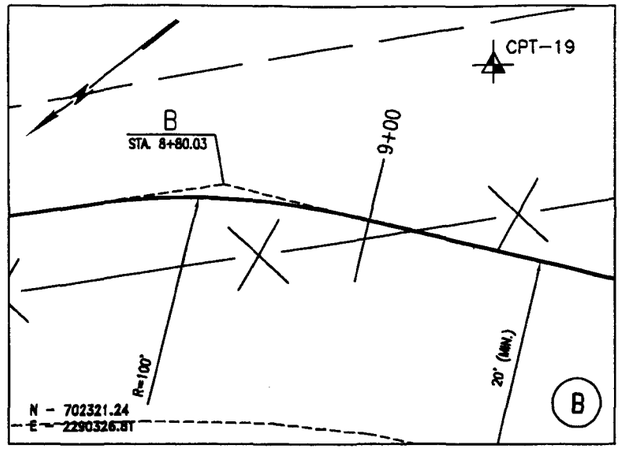
INQUIP ASSOCIATES, INC
McLEAN VIRGINA

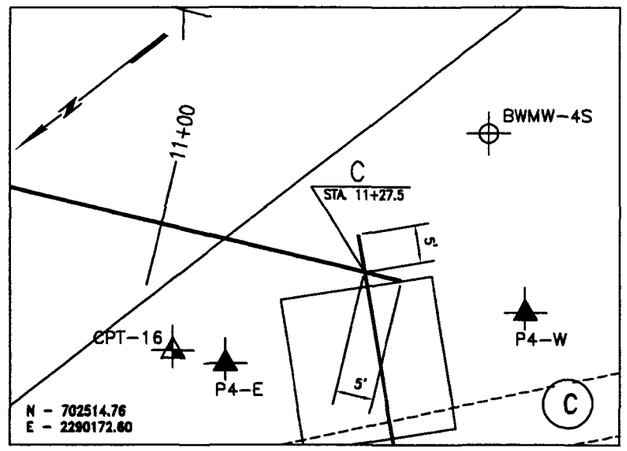
MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C.	DATE 8-07-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-07-03	10060

BARRIER PLAN AND PROFILE, STA. 31+8.78 TO STA. 37+96.51 — DRAWING NO. 7

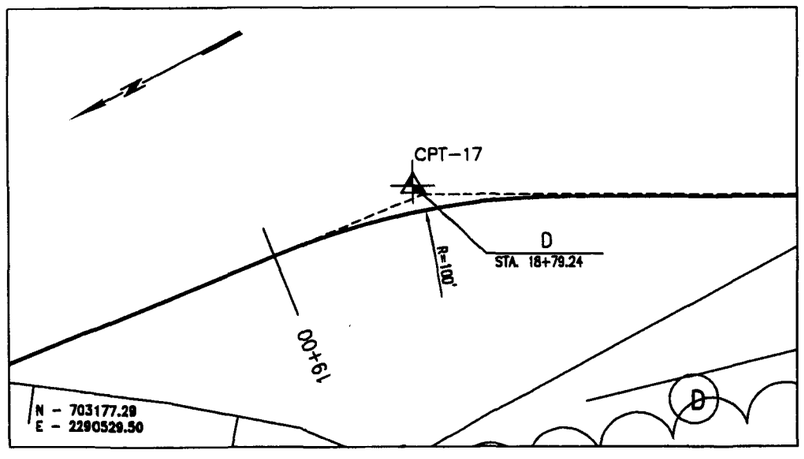


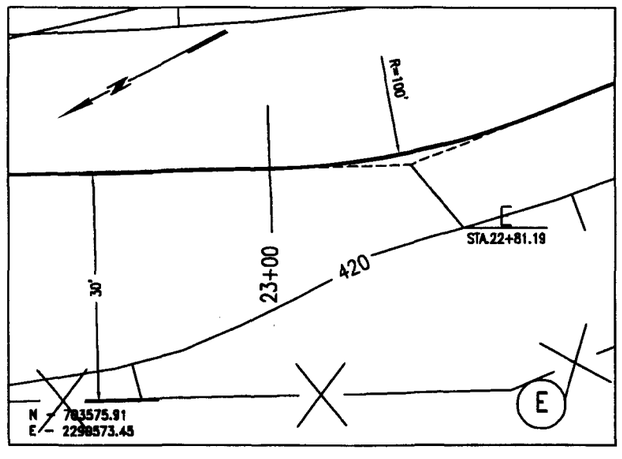


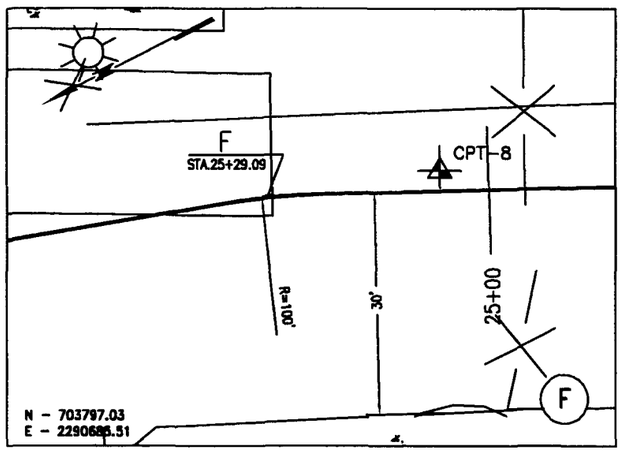


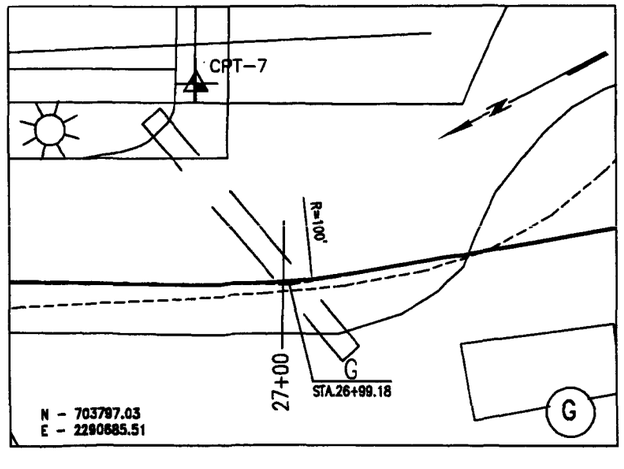
NOTE:

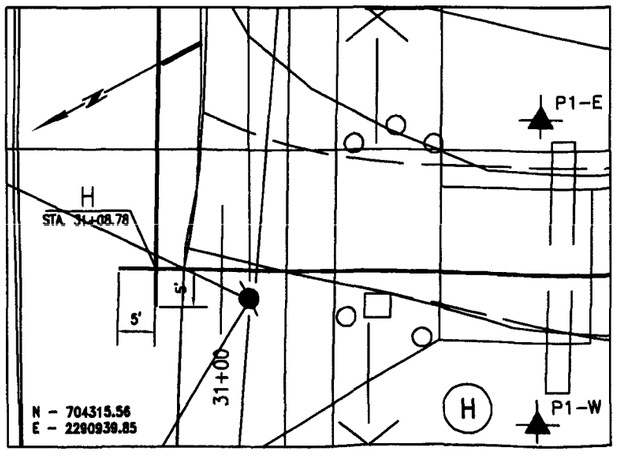
Stations shown are at barrier centerline.

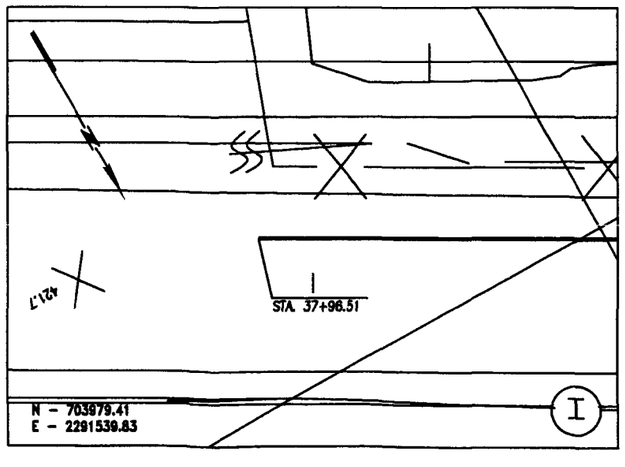








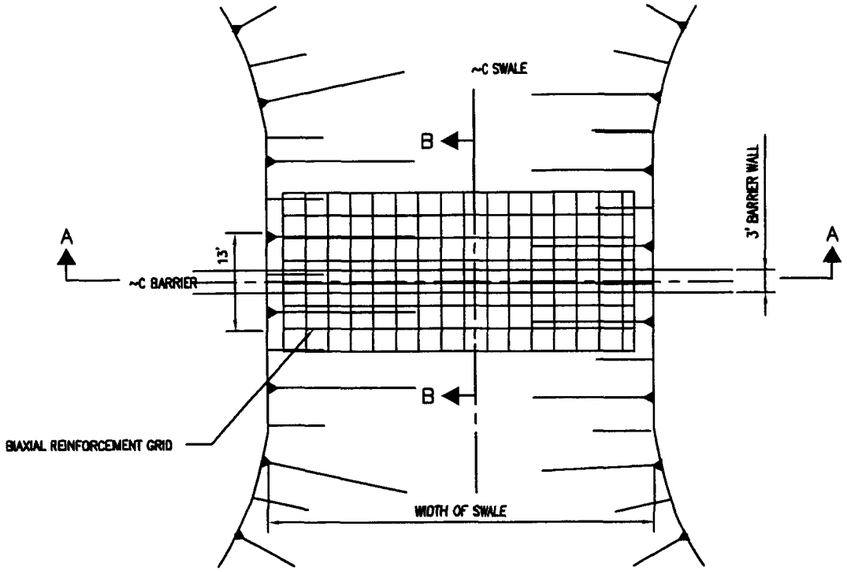




PRELIMINARY
09-16-03

SOLUTIA, INC SITE R	
SAUGET	ILLINOIS
INQUIP ASSOCIATES, INC	
McLEAN	VIRGINA
MUESER RUTLEDGE CONSULTING ENGINEERS 14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122	
SCALE: AS NOTED MADE BY E.C. DATE 8-12-03 CHKD BY K.R. DATE 8-12-03	FILE NO. 10060
CONTROL POINTS	DRAWING NO. 8

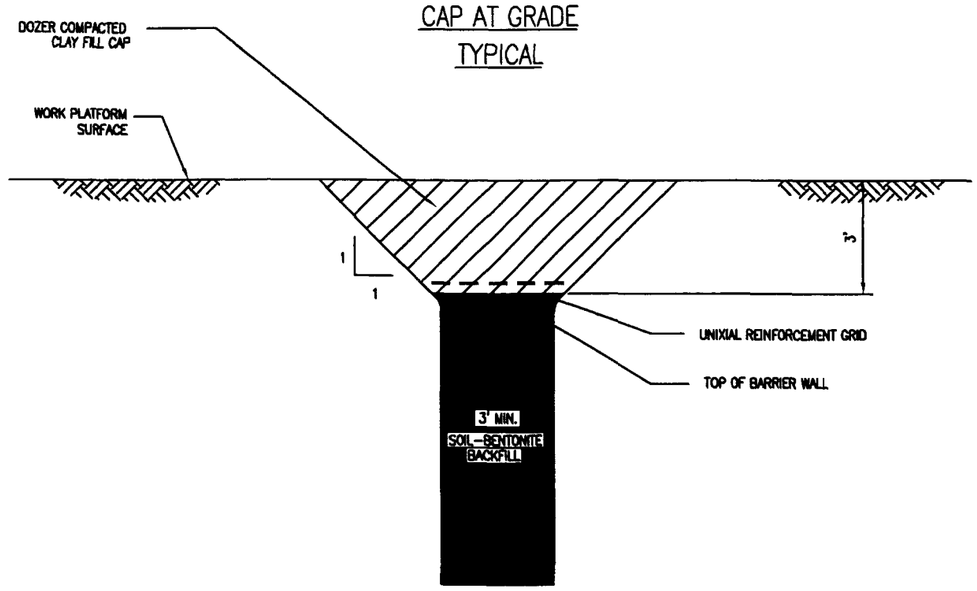
CAP BELOW SWALE



GRAPHIC SCALE

10' 5' 0 10' 20'

CAP AT GRADE TYPICAL

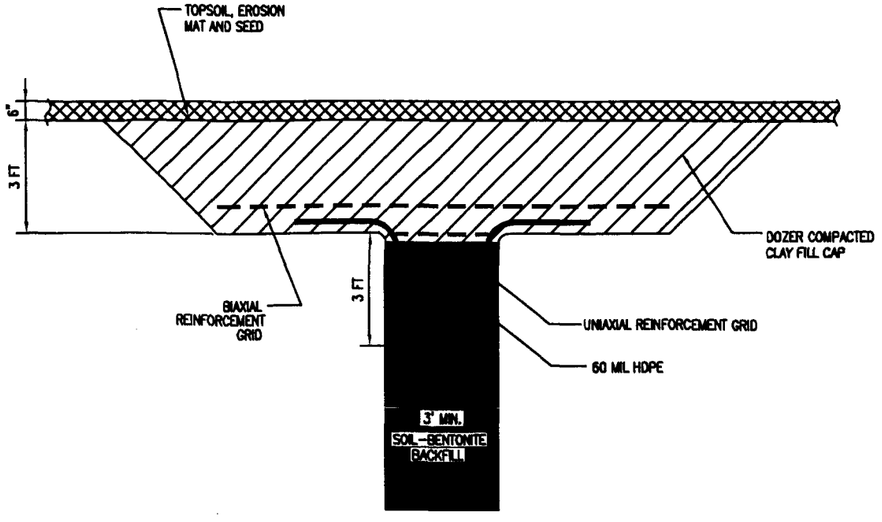


CAP DETAILS

GRAPHIC SCALE

2' 1' 0 2' 4'

CAP BELOW SWALE

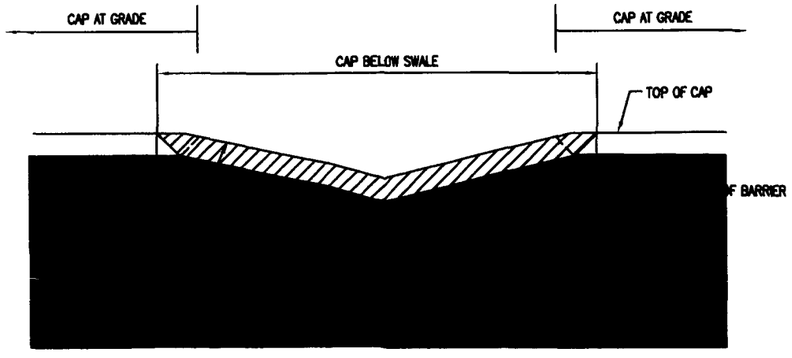


SECTION B-B

GRAPHIC SCALE

2' 1' 0 2' 4'

CAP AT GRADE



SECTION A-A

GRAPHIC SCALE

10' 5' 0 10' 20'

CAP BELOW SWALE

A. Remove work platform to preconstruction grade.

B. Excavate backfill and place HDPE liner. Hold liner in place with pins.

C. Replace backfill in loose lifts (not to exceed 18").

D. Place uniaxial reinforcement grid.

E. Place biaxial reinforcement grid.

F. Place compacted clay cap and topsoil.

CAP AT GRADE

A. Excavate backfill and notch top of trench.

B. Place uniaxial reinforcement grid.

C. Place clay fill above work platform, in loose lifts (not to exceed 18"), and compact with dozer, taking care not to mud-wave backfill.

D. Allow cap settlement for 5 days. Compact with two dozer passes each day.

E. Cut cap level with ground/work platform.

NOTES:

1. Uniaxial Reinforcement Grid tensile strength at 5% strain shall be greater than or equal to 2000 lb/ft (Tensar UX1400HS or equiv.) Grid shall be a minimum of 3 ft wide.

2. Biaxial Reinforcement Grid tensile strength at 5% strain shall be greater than or equal to 1300 lb/ft (Tensar BX1500 or equiv.) Grid shall be a minimum of 13 ft wide.

PRELIMINARY

09-16-03

SOLUTIA, INC
SITE R

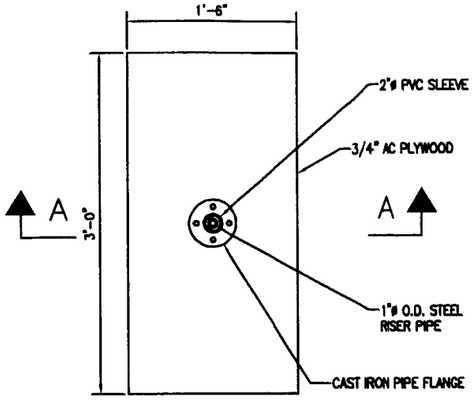
SAUGET ILLINOIS

INQUIP ASSOCIATES, INC

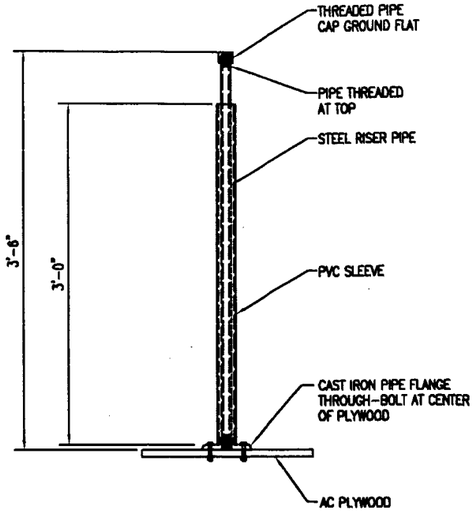
McLEAN VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA - 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C	DATE 8-21-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 8-21-03	10060
CAP DETAILS			DRAWING NO. 9



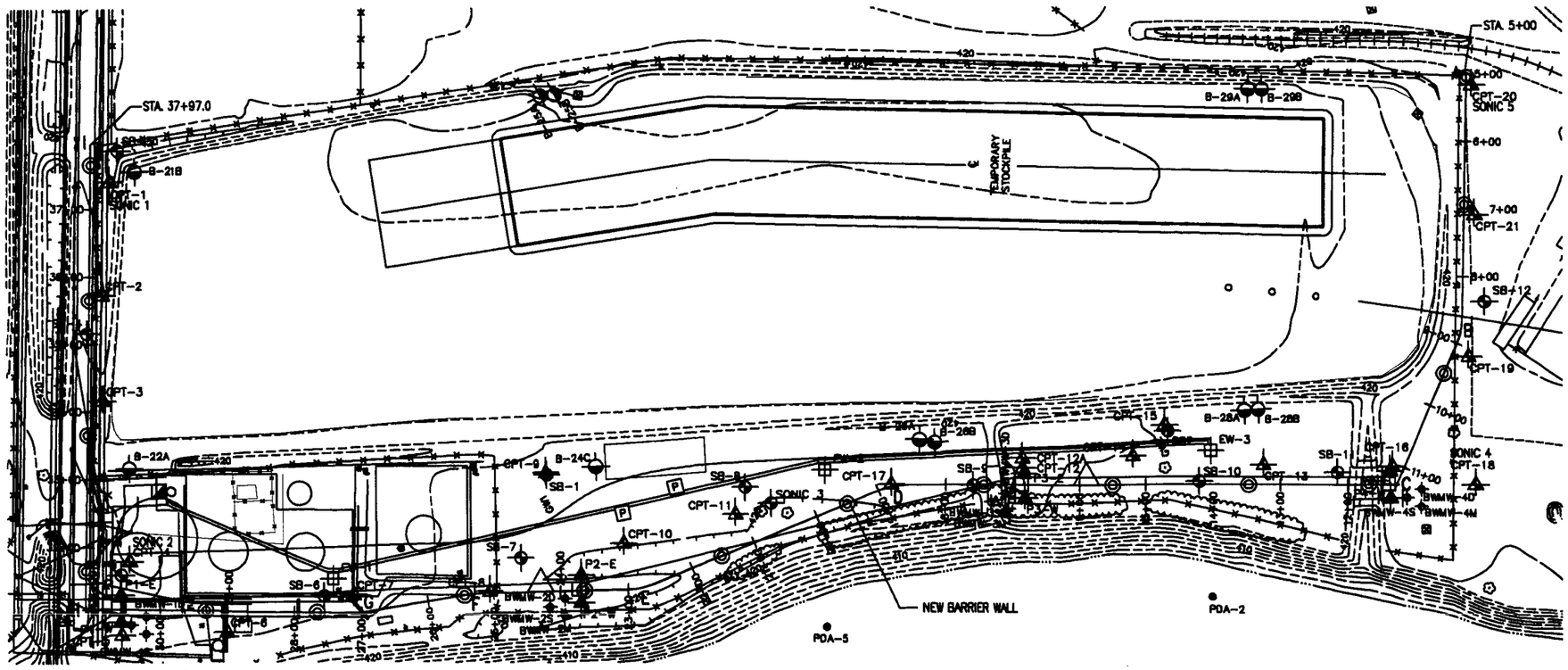
BACKFILL SETTLEMENT MONITORING PLATE
SCALE: 1 1/2"=1'-0"



SECTION A-A
SCALE: 1 1/2"=1'-0"

NOTES:

1. Backfill Settlement Monitoring Plates shall be place at 200 ft spacing along barrier centerline. At lead-in slope, plates shall be placed after the overlap joint is completed and backfill has progressed for the second placement.
2. Place settlement plat on S-B backfill surface 18" below ground level after backfill placement has moved 50 ft beyond plate location.
3. Survey elevation of top of riser pipe immediately after installation. Survey daily thereafter (except Saturday and Sunday). Provide tabular summary of survey to Owner.
4. Settlement plates shall be identified by construction station at actual location.
5. Remove plates before cap placement.



LEGEND

- CPT - CONE PENETROMETER LOCATION (2001)
- SONIC - SONIC BORING LOCATION (2002)
- SB - STANDARD PENETRATION TEST BORING (2001 AND 2002)
- SETTLEMENT PLATE

PRELIMINARY
09-16-03

SOLUTIA, INC
SITE R
SAUGET ILLINOIS

INQUIP ASSOCIATES, INC
McLEAN VIRGINA

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA - 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY E.C	DATE 9-04-03	FILE NO.
AS NOTED	CHKD BY K.R.	DATE 9-04-03	10060

BACKFILL SETTLEMENT MONITORING

DRAWING NO. 10

September 29, 2003

INQUIP ASSOCIATES, INC.
CONTRACTOR'S BARRIER WALL CONSTRUCTION & QUALITY CONTROL PLAN

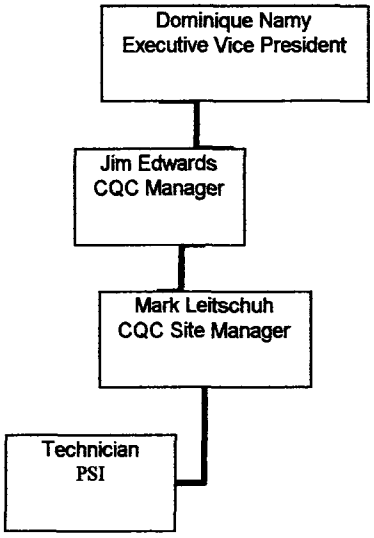
SOIL-BENTONITE SLURRY WALL
ST. LOUIS, MS

1. Quality Control

Quality Control Organization

Inquip Associates, Inc., is committed to conducting all phases of this project with a consistently high level of quality and reliability. Utilization of proven construction methods and attention to consistent and systematic quality control testing will allow Inquip to achieve these goals. The designated CQC Manager for the project is Jim Edwards and the CQC Site Manager is Mark Leitschuh. They will review all quality control data on a daily basis to ensure that the work is performed to the specified standards. The chart below shows the lines of authority for Inquip's Quality Control Organization. The resumes of the individuals named are attached.

INQUIP ASSOCIATES, INC.
QC ORGANIZATION CHART



Executive Vice President: Dominique Namy as Executive Vice President of Inquip has the overall responsibility for the quality of work produced by the company on all east coast projects. He has total authority to do whatever is necessary to ensure a high level of quality on every project. He routinely reviews testing reports and discusses them with the CQC Managers and the CQC Site Managers to ensure adherence to Inquip's CQC Program.

CQC Manager: Jim Edwards as CQC Manager for the project reports directly to the Executive Vice President on all matters regarding the quality of work on the project. He is responsible for the overall management of CQC Plan. Mr. Edwards has the authority to act on all CQC matters for Inquip Associates, Inc.

CQC Site Manager: Mark Leitschuh as CQC Site Manager reports to the CQC Manager on all matters regarding Quality Control on the project site. He is responsible for monitoring all activities on the site to ensure compliance with the contract CQC plan. His duties include performing inspections, overseeing testing, keeping records, and notifying the CQC Manager of any noncompliance with the contract requirements. He has direct access to the CQC Manager and the Executive Vice President who will ensure that the proper corrective action is taken.

Quality Control Technician: Provided by Precision Service Industries the quality control technician will be responsible for performing the contractor's quality control testing and monitoring. The technician will report directly to the CQC Site Manager and perform additional quality control duties as necessary.

Submittals

Submittals will be managed as specified in the project documents. For the slurry trench work we anticipate using Pangea Inc. for portions of the site preparation work. The only material to be incorporated into the work is the premium grade sodium montmorillonite bentonite for which manufacture certificates of compliance will be provided per truckload delivered to the site.

Control Procedures

Procedures for controlling activities related to inspection, testing, and noncompliance conditions are outlined below.

Inspection: Preparatory, initial, and follow-up inspections will be performed by the CQC Site Manager to verify compliance with the plans and specifications. These inspections include visually examining the material, equipment, workmanship, and test records for all aspects of the project. Results of these inspections will be noted on the daily quality control sheets.

Testing: Tests will be performed as specified in the project documents. All field tests will be performed by the CQC Site Manager or one of his staff fully qualified by experience to perform the test. A testing lab approved by the engineer will provide laboratory testing for gradations and hydraulic conductivity. Bentonite slurry testing and slump and density testing of the soil bentonite backfill will be performed on the site.

The CQC Site Manager will verify the following:

- That the testing procedures comply with contract requirements
- That the testing equipment is available and complies with testing standards
- That the testing instruments are properly calibrated
- That recording forms including all of the test documentation requirements have been prepared

Noncompliance: The CQC Site Manager will notify the CQC Manager of any noncompliance with the contract requirements. Inquip shall after receipt of such notice immediately take corrective action. The cause of the noncompliance will be determined and corrective action in the system will be made to preclude recurrence of noncompliance.

Reporting Procedures

Inquip Associates, Inc. uses a daily on-site reporting system that documents the quality control testing conducted and involves the clients engineer in all QC/QA observations. Inquip's daily Slurry Trench Quality Control form will be filled out each day by the CQC Site Manager and reviewed with the Engineer and the CQC Manager for compliance. These forms will be filled out in triplicate with one copy to the engineer, one to the CQC Manager, and one left on site at all times. A copy of the daily report is attached.

2. **List of Equipment:** (Submittal 2290, 1.4, A. 1,2,&3)
Following is a listing of the equipment anticipated for the work:

a. A Koehring Model 1266 (or equivalent) hydraulic backhoe with extended dipper stick capable of excavating in excess of 90 feet will be used for excavating the upper trench. A heavy duty "V" bottom rock bucket a minimum of 3 feet wide will be used to excavate through the upper clay and sand/gravel layers as shown on the project drawings.

b. Two KS3000 hydraulic clamshells will be used to excavate the trench from where the backhoe stops to the top of bedrock.

c. Caterpillar JD 850 dozer (or equivalent) will be used for mixing and blending of the backfill and also for placement into the trench when the mixing takes place adjacent to the trench.

d. A small excavator will be used to load trucks with backfill for delivery from the remote backfill mix area.

e. Contractor's slurry plant consisting of a venturi-type slurry mixer, sumps, pumps, piping, valves, fittings and hose/piping will be used for mixing and distribution of the slurry. Plant capacity is 400 to 500 gpm of continuous slurry output.

f. Welding Machine for necessary repairs to equipment, etc.

g. Caterpillar JD 644H (or equivalent) with a $3\text{-}^1/_4$ cu. yd. loader bucket and forklift attachments will be used for unloading and setting up mixing plant, unloading bentonite

in jumbo bags from trucks, handling bentonite during the mixing operation, handling and moving of slurry and water lines, and for any other required on-site work.

h. A 4-inch 75 horse power mission pump will be used for pumping bentonite slurry to the trench from the hydration ponds and recirculation within the ponds.

3. Methods of Construction: Anticipated methods of construction for specific operations are as follows:

a. **Preparation of the Working Platform Erosion Control:** Erosion control devices will be installed in accordance with the Storm Water Pollution Prevention Plan (SWPPP). Pretrenching to a depth of twenty feet will be done ahead of the formal wall construction to expose any abandoned or unknown utilities or obstacles. Typically, the work pad will be leveled, or have a small longitudinal slope, so that we can maintain the specified slurry elevation in the open trench. It will be a minimum of 12 feet wide on the outside of the new slurry trench. Its width on the inside will vary depending upon the location. A graveled work pad for the KS 3000 clams to work from will be installed along the trench. This work will involve the following operations:

- Stripping, clearing and grubbing the existing vegetation.
- Leveling of the trench alignment using cut and fill operations.

b. **Staging Area:** The site office area, slurry mixing, and staging area slurry hydration ponds will be centrally located inside the work area. Upon approval by the owner, the exact location of the staging area will be determined in the field, prior to mobilization.

c. **Bentonite Slurry Preparation:** (Submittal 2290, 1.4, A.1) Federal Jel 90 sodium montmorillonite bentonite clay meeting the specifications will be used (see attached data sheets and certification letter). Submittals for the bentonite will contain the Technical Data Sheets showing physical and chemical properties and a Material Safety Data Sheets (MSDS). Certificates of compliance with the specifications will be provide by the manufacturer and submitted to the owner upon delivery of the materials. Bentonite for the trench stabilization slurry will be delivered by pneumatic unloading tractor-trailers. Bentonite for mixing dry into the backfill (if required) will be either powered or granular delivered in approximately 4,000 pounds jumbo bags or delivered by tractor-trailers. A hydrant adjacent to the work area will provide the water for preparation of the slurry. Four-inch HDPE pipe will be used for delivery of water to the mixing area from the hydrant and connected directly to the mixer. The mixing of bentonite and water will be performed in a venturi (high shear) mixer along with necessary pumps, hose and piping to result in slurry exceeding the specification slurry after recirculation and/or hydration in a storage pond. Higher than required viscosity slurry is necessary to compensate for any rain or other dilution that may occur in the hydration pond. Density

and marsh funnel tests will be used to control the production of the slurry. Viscosity adjustment of the slurry that exceeds the minimum specification requirement may be made as the slurry is pumped from the storage ponds by thinning with water at the pump suction or by recirculation and thinning. Control of thinning will be done by using the marsh funnel to measure viscosity.

d. **Bentonite Slurry for Trench Stabilization:** The bentonite slurry for stabilization of the slurry wall excavation shall be introduced into the trench at the time trenching is begun and shall be maintained within three feet of the top of the trench at all times during excavation and at least three feet above the groundwater level.

e. **Slurry Wall Excavation:** (Submittal 2290, 1.4, A.3) A Koehring 1266 hydraulic backhoe with extended dipper stick and a 36-inch (minimum) wide bucket will be used for slurry wall excavation to approximately 85 feet below the work pad. The KS 3000 clamshells will excavate from where the backhoe stopped to the top of bedrock. The trench stationing shall be offset from the centerline by 20 feet and staked at 50 foot intervals. The centerline shall be marked with small painted stakes or wire flags for the backhoe operator to line up on. The trench will be maintained full with bentonite slurry, pumped from the slurry pond. The excavation will proceed by making successive cuts approximately 30 feet long. The excavation process will provide for insurance of trench continuity. The depth of the trench will be recorded upon reaching the top of the bedrock. The Owner's Representative will verify the top of bedrock for every cut. The material excavated from the trench to be used in the backfill will be cast to the mixing area adjacent to the working platform or loaded into trucks for transport to the remote mixing area. Material not to be used as backfill will be transported to the disposal area on site. An earth berm will be constructed along the outer side of the trench as necessary to prevent runoff from carrying sediments and excavated material into the trench. When the desired depth of the bottom of the trench has been reached as determined by the Engineer, it shall be cleaned and sounded to the satisfaction of the Engineer. Soundings for the final bottom of the excavated trench shall be made from the working platform surface at 10 foot intervals performed to the satisfaction of the Engineer. Samples of the key strata material shall be obtained with the clamshell bucket. Where corners are required on the slurry wall alignment, overlaps on the trench bottom of 5 feet in each direction will be made. The corner shall be cleaned in each direction by re-excavation by the clamshell to assure that there is no loose or un-excavated material at or immediately adjacent to a corner on the slurry wall alignment.

f. **Soil-Bentonite Backfill:** (Submittal 2290, 1.4, A.4) The soil-bentonite backfill mixture shall consist of the soils from the trench excavation. Dry bentonite (if required) will be placed on the working platform in advance of the trench excavation as required to meet the specifications. Four thousand (4000) pound jumbo bags will be prepositioned along the working platform in the backfill mixing area according to calculations using the profile

as shown on the drawings. The dry bentonite and excavated soils shall be mixed with slurry either from the trench or from the hydration pond so that the final mixture will have the proper slump upon placement into the trench. It is anticipated that the final soil-bentonite mixture will have a slump of between 2 and 6 inches upon placement in the trench. The soil-bentonite backfill mixture will be mixed on the working platform alongside the trench or in the remote mixing area using a JD850 (or equivalent) dozer. The dozer will mix and knead the material until it results in a homogeneous mixture. Except for occasional soil lumps of up to 3 inches in size, the mixture will be homogeneous. Initial trench backfill at the beginning of each slurry wall shall be placed by constructing a lead in trench on a 1(h):1(v) slope at the beginning of trench excavation. Sounding of the trench bottom will be performed prior to the placement or progress of the toe of the backfill in the trench in accordance with paragraph e. above. The initial trench backfill will be pushed into the trench at the beginning of this slope by the dozer and allowed to slide down until sufficient backfill has been place to result in the natural angle of repose of the backfill under the slurry. Then the dozer will place additional backfill where the point of placement is adjacent to the backfill mixing area. This backfill will be placed into the trench on the face of the previously placed backfill as it daylights above the slurry. At the terminal end of the trench the bentonite slurry shall be removed using the backhoe bucket as the backfill comes into contact with the vertical face of the trench that joins the previously completed slurry wall. This process will insure that pockets of slurry are not trapped in the backfill as it rises from the bottom to the top of at the terminus of the trench. Some of this slurry will be used to mix backfill. Soil-bentonite backfill will be placed to the top of the trench at all locations. Mixing and placing of trench backfill will not be performed during cold weather when ice forms or is contained in the backfill mixture.

g. **Excessive Slurry Loss:** (Submittal 2290, 1.4, A.5 & 6): Sudden slurry loss usually occurs when a pipeline which intersects the trench alignment is damaged during excavation. When this occurs, a large volume of bentonite slurry is allowed to flow out of the trench. To help prevent this type of slurry loss, Inquip will review with the Construction Manager the available site drawings which show previously installed pipes, culverts, etc.. The general locations will be laid out in the field. We will then excavate a 2' wide to 20' deep pretrench along the slurry wall centerline. This trench will be excavated under bentonite slurry. We will attempt to locate the suspected pipe and slurry wall intersections. All abandoned pipes will be removed and their ends plugged. If an unknown pipe is ruptured during slurry trench excavation, resulting in sudden slurry loss, soil material excavated from the trench will be dumped or bulldozed at the location of the excavation equipment where the breach in the pipe occurred. The pump operator will pump slurry from the ponds to the trench and soil bentonite backfill will also be placed to raise the slurry level. Excavation of the slurry wall will cease in this area until the pipe is located, by potholing, on both sides of the slurry wall. When located the pipe will be plugged on either side of trench centerline and excavation will resume. Sudden slurry loss can also occur in porous

soil conditions. If this should occur we will proceed, as described above, to backfill the trench and raise the slurry level. After the sudden slurry loss is stopped, we will attempt to begin re-excavation of the porous area. During this re-excavation process the operator will repeatedly dump the soil out of the bucket and through the bentonite slurry, increasing the soil particles in suspension. Using this method we attempt to seal the porous area using a thickened slurry. Dry bentonite in 100# bags can also be added at the location of the sudden slurry loss by directly dropping the 100# bag of bentonite through the trench slurry at the location of the sudden slurry loss. If neither method eliminates the sudden loss of bentonite slurry, it may be necessary to grout the porous zone. A drill rig would be mobilized as quickly as practical, and a permeation grouting program started. The extent of the grouting required would be determined mutually by Inquip and the Construction Manager.

h. **Slurry Wall Cap:** Upon completion of backfilling sections of the slurry trench and prior to drying of the backfill, a curing cap of backfill material will be placed over the backfilled trench as shown on the drawings.

i. **Site Cleanup:** (Submittal 2290, 1.4, A. 13) During construction or after completion of the cap all remaining excess and waste materials left on the working platform will be properly graded and leveled to a state acceptable to the Engineer. Excess slurry from the terminal end of the trench which is not used in the backfill mixture shall be disposed of in the designated area by spreading on the working platform or adjacent area and mixing into the top 6 inches of surface soil. Slurry ponds shall be pumped dry. Excess slurry from ponds may be mixed with soil and allowed to dry out and then placed back into the ponds as approved by the Engineer.

4. Materials Test Log: See attached Materials Test Log.

5. Barrier Wall Design: To be submitted under separate cover will be the design documents produced by Mueser Rutledge Consulting Engineers and stamped by a Professional Engineer registered in the state of Illinois. The design documents consist of trench stability calculations, construction drawings 1 to 9, and a specification for soil bentonite slurry wall construction.

GENERAL TEST LOG
7603, Groundwater Mitigation Control System, Sauget Area 2

Section 2290, Soil-Bentonite Barrier Wall	**Frequency**	**Specification**
Water Sample	Water to be used in mixing operations, once prior to the start of mixing operations then once per month thereafter.	hardness <500ppm
Initial Slurry prior to placement in trench, viscosity, filtration, density, sand content & pH	2 times daily while mixing / 1 time daily when not mixing	Viscosity 40 - 65 seconds Density ≥ 63.5 pcf Filtration ≤ 20 cc. in 30 minutes Sand Content ≤ 2% pH 7 - 9
Trench slurry tested for viscosity, filtration, density, sand content & pH	1 time daily for top sample taken from within 100 ft of excavation toe, sampled 5 ft below the slurry surface. 2 times daily for bottom sample taken from within 100 ft of the excavation toe, sampled 5 ft above the trench bottom	Viscosity 40 - 100 seconds Density 64 – 80 pcf, bottom sample always 15 pcf < backfill Filtration ≤ 20 cc. in 30 minutes, filter cake ≤ ¼ inch Sand Content ≤ 20% pH 7 – 10.5
Slump of Backfill ASTM C-143	One/ 200cy or 2 per day min.	3" – 5", avg. of all tests ≤ 4 inches
Backfill Soil Gradation	One/ 800cy or 1 per day min.	3" – 100% 1" – 85% ½" – 75-100% #4 – 60-100% #10 – 50-100% #40 – 35-75% #200 – 20-40%
Backfill Bulk Wet Density	One/300cy or 2 per day min.	N/A
Backfill Water Content	One/300cy or 2 per day min.	N/A
Backfill Permeability Determinations	One/1,200cy or 1 per week minimum	1.0×10^{-7}
Sediment Thickness	At 20 ft construction stations after cleaning sediment immediately before backfill placement with flat weight within 50 to 60 feet from the backfill toe.	Pointed and flat weight measurement within 0.25 ft. or deeper from initial trench bottom. Thickness of sediment not to exceed 0.25 ft.
Backfill Sampling	Minimum of three locations with split spoon sampler daily, in presence of owner, before placing backfill to determine if backfill surface must be cleaned.	< 2 inches of sediment
Settlement Monitoring Plates	Placed 18" below backfill surface at 200 ft spacing along barrier wall within 24 hours of backfill completion within 50 ft of plate location.	Elevation recorded daily until owner indicates that cap installation may begin.
Backfill Slope	At 20 foot interval within 100 ft of the toe and at 60 feet intervals otherwise	Performed with flat weight

Backfill Samples	1 per week	Two 20lb. samples to owner for QA testing
Bentonite Certifications	As each new lot is delivered	API Specification 13A, Section 4 and 5

Section 2320, Construction Spoils Handling	**Frequency**	**Specification**
TCL/TAL Testing	For each new off site borrow source. One per every 5000 yd3	Compare to TACO Tier 1 criteria
Compacted Fill Testing Requirement: ASTM D2216 ASTM D4318 ASTM D1140 ASTM D698	 1 per 15,000 yd3 1 per 15,000 yd3 1 per 15,000 yd3 1 per 15,000 yd3	For 4" leveling layer or 12" stockpile cover soil: Silty to Clayey Sands SP, SP-SM, SC-SM Clayey Silts to Silty Clays CL Silty Sandy Clays CL Combinations of the above For Berms: Clayey Silts to Silty Clays CL Silty Sandy Clays CL Gravelly Clay CL Combinations of the above The plasticity index shall be 7 or greater
Post Constructed Quality Control Compacted Fill In –place density ASTM D2922 ASTM D3017 In-place density verification ASTM D2937 ASTM D2216	 1 per 2,000 yd3 placed and compacted 1 per 15,000 yd3 placed and compacted	 90% ± 4% of optimum 90% ±4% of optimum